A PENTON PUBLICATION U.S. $10.00

ELECTRONIC DESIGN

SEPTEMBER 16, 1993

FOR ENGINEERS AND ENGINEERING MANAGERS—WORLDWIDE

17 NOV 1993

ENCODING SCHEME PUTS 100-MBIT/S FDDI OVER TWISTED PAIRS

- ADVANCED TECHNOLOGY SERIES: MASS STORAGE
- PREVIEWS:
  - WESCON
  - BIPOLAR/BICMOS CIRCUITS AND TECHNOLOGY MEETING
- COMPUTER SYSTEMS DESIGN SECTION
- PEASE PORRIDGE

ED 825799141 P 2N 4
T MAHER MGR 2385
DETECTION SYSTEMS P L 34994
PO BOX 397 BAYSWATER
AUSTRALIA 124

QUICKLOOK

Theirs

- ? Virtually unlimited capacity.
- ? 32 layer definitions.
- ? 16 routing layers.
- ? Assignable Power and Ground layers.
- ? Copper pour for copper zones.
- ? All object, on line editing. (Point and edit.) (Apply edit uniquely, locally, or globally.)
- ? Compound pad stacks with full rotation.
- ? Ability to import sections of existing boards for new design.
- ? Automatic footprint generators.
- ? Delete and undelete for all objects in the data base.
- ? Over 1,000 footprints. (All SMT Manual footprints.)
- ? Ability to create multipackage interconnected modules.
- ? Full dimensioning capability.
- ? All angle on or off grid manual routing with visual copper spacing.
- ? Arcs and circles for traces and outlines.
- ? Move, drag and place with 0.01 degree rotation resolution.
- ? Full support for release to manufacturing.
- ? **High quality autorouter, 16 layers simultaneously.**

$10,000+

OrCAD®

- ☑ Virtually unlimited capacity.
- ☑ 32 layer definitions.
- ☑ 16 routing layers.
- ☑ Assignable Power and Ground layers.
- ☑ Copper pour for copper zones.
- ☑ All object, on line editing. (Point and edit.) (Apply edit uniquely, locally, or globally.)
- ☑ Compound pad stacks with full rotation.
- ☑ Ability to import sections of existing boards for new design.
- ☑ Automatic footprint generators.
- ☑ Delete and undelete for all objects in the data base.
- ☑ Over 1,000 footprints. (All SMT Manual footprints.)
- ☑ Ability to create multipackage interconnected modules.
- ☑ Full dimensioning capability.
- ☑ All angle on or off grid manual routing with visual copper spacing.
- ☑ Arcs and circles for traces and outlines.
- ☑ Move, drag and place with 0.01 degree rotation resolution.
- ☑ Full support for release to manufacturing.
- ☑ **High quality autorouter, 16 layers simultaneously.**

$2,495

The choice is clear.

For your free demo disk of OrCAD's new PCB 386+ design tool, call 503-690-9881 today. OrCAD Europe 33-1-45 75 50 00

OrCAD®

The leader in board design tools for the PC

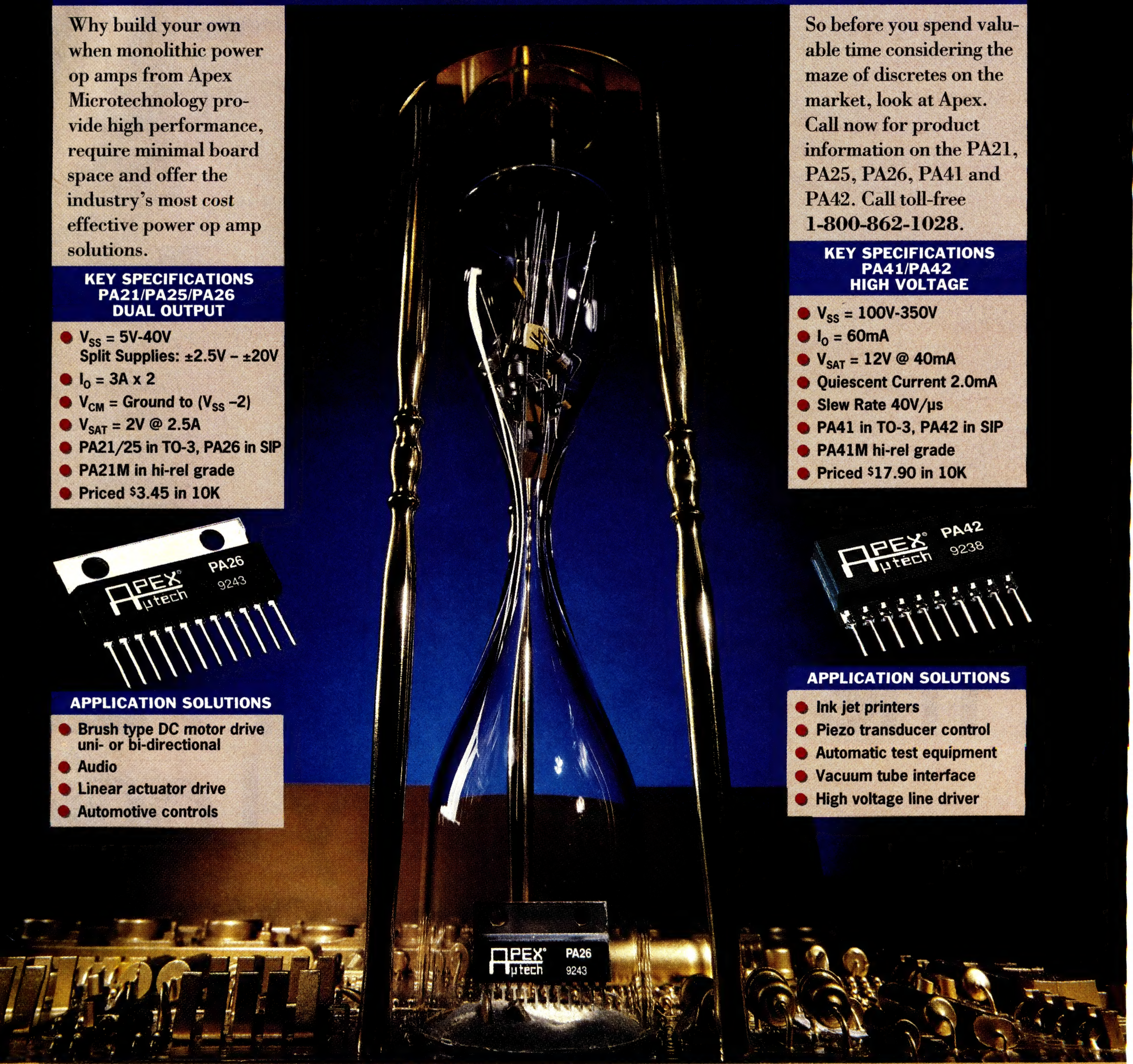
CIRCLE 178 FOR U.S. RESPONSE

CIRCLE 179 FOR RESPONSE OUTSIDE THE U.S.

SAVE TIME...SAVE MONEY...SAVE BOARD SPACE

Monolithic Power Amps

Keep Valuable Design Time From Slipping Away



Why build your own when monolithic power op amps from Apex Microtechnology provide high performance, require minimal board space and offer the industry's most cost effective power op amp solutions.

KEY SPECIFICATIONS
PA21/PA25/PA26
DUAL OUTPUT

- V_{SS} = 5V-40V
  Split Supplies: ±2.5V – ±20V
- I_O = 3A x 2
- V_{CM} = Ground to (V_{SS} –2)
- V_{SAT} = 2V @ 2.5A
- PA21/25 in TO-3, PA26 in SIP
- PA21M in hi-rel grade
- Priced $3.45 in 10K

APPLICATION SOLUTIONS

- Brush type DC motor drive uni- or bi-directional
- Audio
- Linear actuator drive
- Automotive controls

So before you spend valuable time considering the maze of discretes on the market, look at Apex. Call now for product information on the PA21, PA25, PA26, PA41 and PA42. Call toll-free **1-800-862-1028.**

KEY SPECIFICATIONS
PA41/PA42
HIGH VOLTAGE

- V_{SS} = 100V-350V
- I_O = 60mA
- V_{SAT} = 12V @ 40mA
- Quiescent Current 2.0mA
- Slew Rate 40V/μs
- PA41 in TO-3, PA42 in SIP
- PA41M hi-rel grade
- Priced $17.90 in 10K

APPLICATION SOLUTIONS

- Ink jet printers
- Piezo transducer control
- Automatic test equipment
- Vacuum tube interface
- High voltage line driver

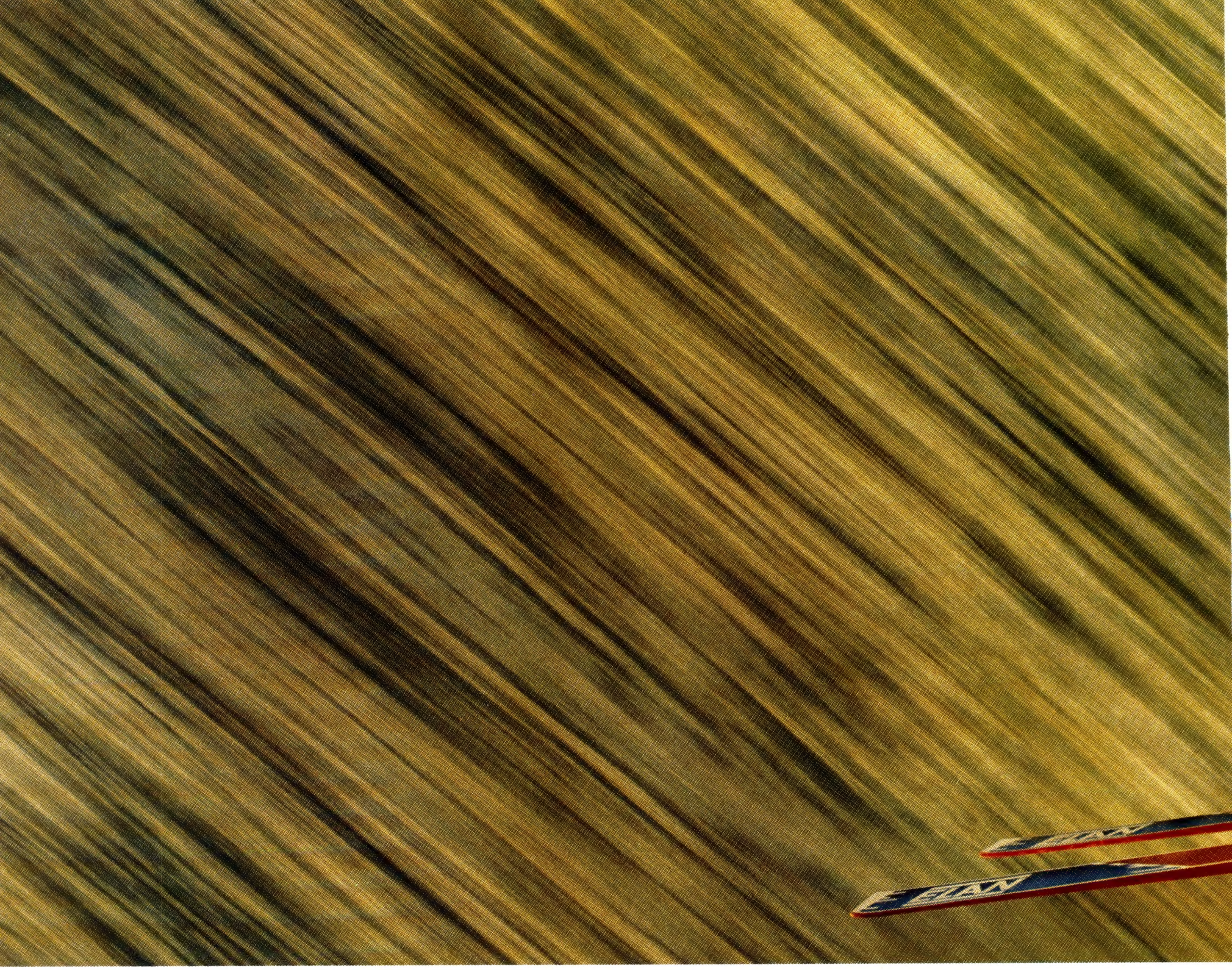
For Immediate
Product Information,
or to Place an Order
Call **1-800-862-1028**
or FAX **(602) 888-3329**

APEX μtech
DEDICATED TO EXCELLENCE
APEX MICROTECHNOLOGY CORPORATION
5980 N. SHANNON ROAD, TUCSON, ARIZONA 85741

For Applications
Assistance Call Toll
Free **1-800-862-1028**
or FAX **(602) 888-7003**
Deutsch Gesprochen
0130 81 3599

AUSTRALIA, NEW ZEALAND *(08) 277 3288* ***BELGIUM/LUXEMBOURG*** *(03) 458 3003* ***CANADA*** *(613) 592 9540* ***DAEHAN MINKUK*** *(02) 745 2761* ***DANMARK*** *(45) 97 25 0816*
DEUTSCHLAND *(6172) 5113* ***ESPAÑA*** *(1) 530 4121* ***FRANCE*** *(1) 69 07 08 24* ***HONG KONG*** *8339013* ***INDIA*** *(212) 339836* ***ISRAEL*** *(3) 9345171* ***ITALIA*** *(2) 99041977*
NEDERLAND *(10) 451 9533* ***NIPPON*** *(3) 3244-3787* ***NORGE*** *(2) 50 06 50* ***ÖSTERREICH*** *(222) 505 15 220* ***PEOPLES REPUBLIC OF CHINA*** *(86) 500 7788*
REPUBLIC OF SOUTH AFRICA *(021) 23494* ***SCHWEIZ*** *(49) 6172 5113* ***SINGAPORE*** *(65) 741 8966* ***SUOMI*** *(0) 522 122* ***SVERIGE*** *(8) 795 9650*
TAIWAN—REPUBLIC OF CHINA *(02) 722 3570* ***TURKIYE*** *(1) 337 22 45* ***UNITED KINGDOM*** *(844) 278781*

CIRCLE 90 FOR U.S. RESPONSE CIRCLE 91 FOR RESPONSE OUTSIDE THE U.S.



The New MACH™ PLDs They Defy Logic.

Introducing the newest MACH PLDs, with 5,000-gate densities and absolutely predictable 15ns delays.

Brace yourself. This is going to have a big impact on your next design. We call it the MACH435 PLD. At 5,000-gates, it's the densest member of the MACH family to date. And with 15ns delays every time, you get FPGA density without all the timing uncertainties.

The MACH family is the epitome of predictability. You get worst-case delays of 15ns, in an equally predictable architecture. Because MACH parts are genuine PAL® devices — just like the ones you already use — you'll save startup costs and time using the design tools you already know.

Plus the MACH435 PLD has a host of new features for added predictability, and flexibility. For example, multiple switch matrixes provide global connectivity between macrocells, allowing communication between cells at the same fixed speed.

For more information write "MACH" on your letterhead and mail to, in Europe: AMD Mail Operations, P.O. Box 4, Westbury-on-Trym, Bristol BS9 3DS, United Kingdom; in Asia: Advanced Micro Devices Far East Ltd., Rm. 1201-2 Harcourt House, 39 Gloucester Road, Hong Kong; in Japan: AMD Japan Ltd., Shinjuku Kokusai Bldg., 6-6-2 Nishi-Shinjuku, Shinjuku-ku, Tokyo 160, Japan.

Are So Big And So Fast But Not Predictability.

You can even configure macrocells as synchronous or asynchronous with our new multi-clocking feature.

The MACH435 PLD is available now in 15ns and 20ns versions, as well as a 25ns quarter power version. So when your next design requires a heavyweight PLD that does the impossible on a regular basis, look up the new MACH family of high-density PLDs. For more information, call AMD today.

Model Number	PLD Gates	Macro Cells	Max. Delay	System Speed	I/O Pins
MACH 435	**5000**	**128**	**15ns**	**50 MHz**	**84**
MACH 230	3600	128	15ns	50 MHz	84
MACH 130	1800	64	15ns	50 MHz	84
MACH 220	2400	96	15ns	50 MHz	68
MACH 120	1200	48	15ns	50 MHz	68
MACH 210	1800	64	10ns	80 MHz	44
MACH 215	1500	64	12ns	66.7MHz	44
MACH 110	900	32	12ns	66.7 MHz	44

800-222-9323

Ask for Literature Pack 17P.

Advanced Micro Devices

901 Thompson Place, P.O. Box 3453, Sunnyvale, CA 94088. © 1993 Advanced Micro Devices, Inc. MACH is a trademark and PAL is a registered trademark of Advanced Micro Devices. All other brand or product names are trademarks or registered trademarks of their respective holders.

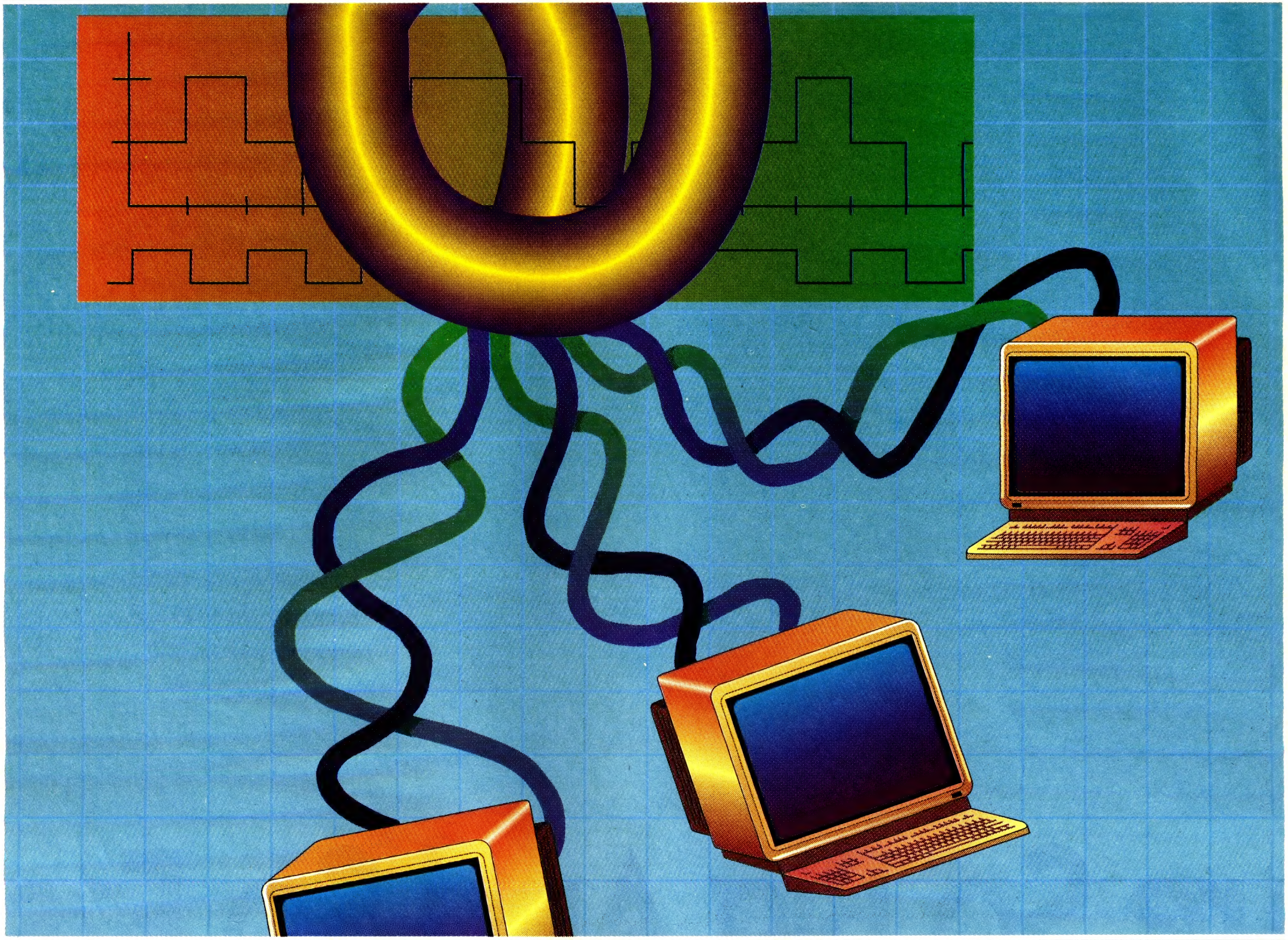
International Sales Offices: Antwerpen (03) 248 43 00; Frankfurt area (06172) 9267-0; Hong Kong 86 54 525; London area (0483) 740 440; Manchester area (0925) 830 380; Milano (02) 353 32 41; München (089) 45053-0; Osaka (06) 243 32 50; Paris (1) 49 75 10 10; Seoul (02) 784 0030; Singapore (65) 348 11 88; Stockholm (08) 98 61 80; Taipei (02) 715 35 36; Tokyo (03) 334 67 550.

CIRCLE 328 FOR U.S. RESPONSE

CIRCLE 329 FOR RESPONSE OUTSIDE THE U.S.

SEPTEMBER 16, 1993 VOL. 41, NO. 19

ELECTRONIC DESIGN



TECHNOLOGY ANALYSIS

APPLIED TECHNOLOGY DOMINATES WESCON/93 . . . 53

Wescon program airs challenges and solutions for exploiting emerging technologies.

RECENT ADVANCES STRETCH BIPOLAR/BICMOS PROCESSES . . . 73

1993 Bipolar/BiCMOS Circuits and Technology Meeting introduces advanced analog/digital processes and ICs.

COVER FEATURE

FDDI RIDES TWISTED PAIR TO THE DESKTOP . . . 85

Three-level coding and adaptive equalization nets 100-Mbit/s transceiver data rate over existing telephone lines.

ADVANCED TECHNOLOGY SERIES

MASS STORAGE LOOKS FOR NEW SOLUTIONS . . . 93

A combination of forces that include changing storage architectures and the increased use of multimedia will foster more innovation.

PRODUCT INNOVATIONS

LOGIC SCOPE SIMPLIFIES DIGITAL CIRCUIT DEBUG . . . 131

A logic analyzer and high-performance DSO combined in one instrument makes life easier for digital designers.

DSP BOARD COMBINES MULTIPLE PERIPHERALS . . . 135

Half-sized pc board integrates a phone, voice-mail system, sound board, and data and fax modems using the Mwave DSP chip.

40
YEARS
OF EDITORIAL
EXCELLENCE

40 YEARS AGO IN ELECTRONIC DESIGN . . . 6
Memory unit for installation in a computer; silicon alloy junction diode; ultra-miniature transformer for transistor radio applications

EDITORIAL . . . 14
Recycling pays—except for acronyms

TECHNOLOGY BRIEFING . . . 18
Databooks go electronic

TECHNOLOGY NEWSLETTER . . . 25
- Consumer giants unveil video-CD standard
- Embedded-PC modules standard ready for O.K.
- Coalition to aid IC-stacking technology
- Data-compression macro suits high-speed buses
- API eases porting to Motif environment
- Color-printer consortium formed
- Fibre Channel gets official organization
- Next-generation games to use 64-bit muscle
- Mixed-signal circuit simplifies pen input

TECHNOLOGY ADVANCES . . . 34
- Leaky fiber with optical taps developed for very wideband cellular wide-area network
- Current-input architecture leads to improved IC ADC
- Enhanced magnetoresistive R/W head promises 50X boost in disk storage
- Simple microcontroller-based scrambling scheme blocks video-cassette viewing

Jesse H. Neal Editorial
Achievement Awards:
1967 First Place Award
1968 First Place Award
1972 Certificate of Merit
1975 Two Certificates of Merit
1976 Certificate of Merit
1978 Certificate of Merit
1980 Certificate of Merit
1986 First Place Award
1989 Certificate of Merit
1992 Certificate of Merit

Cover Illustration: Tom Pennella

IDEAS FOR DESIGN . . . 110
- Switching boost regulator uses 555
- Run optoisolator at 100 kHz, low power
- Keep I_C and V_{CE} constant

PEASE PORRIDGE . . . 115
Bob's Mailbox

QUICK LOOK . . . 120A
- Managers trade time for money with a bias for conserving the latter
- Optical drives—U. S. revenues keep rolling along
- An eye on ISO 9000
- Tips on investing
- Offers you can't refuse

COMPUTER SYSTEMS SPECIAL SECTION
PC Graphics Watch . . . 125
System Design News . . . 126
System Design Products . . . 128

READER SERVICE CARD . . . 136A-D

PRODUCTS NEWSLETTER . . . 137

EUROPEAN PRODUCTS NEWSLETTER . . . 138

NEW PRODUCTS
Digital ICs . . . 141-142, 186
Computer Boards . . . 144
Computers & Peripherals . . . 146
Components . . . 150
Instruments . . . 154
CAE . . . 158
Software . . . 162
Power . . . 168
Packaging . . . 180
Communications . . . 184

READERS' COMMENTS . . . 190

INDEX OF ADVERTISERS . . . 208

COMING NEXT ISSUE

- Special Report: New DSP-based ICs add voice and fax to modems
- Where to find help in using new CAE tools
- Test & Measurement Update: Data-acquisition systems
- Data-acquisition systems feel the impact of new digital-signal processor
- Short-circuit time constants aid analog circuit design
- First details on digital-audio multimedia ICs
- Video encoding and decoding under MPEG standards
- Novel high-speed data interface chips

- PLUS;
Pease Porridge
Ideas for Design
Quicklook

ELECTRONIC DESIGN (USPS 172-080; ISSN 0013-4872) is published semi monthly except for 3 issues in May and 3 issues in November by Penton Publishing Inc., 1100 Superior Ave., Cleveland, OH 44114-2543. Paid rates for a one year subscription are as follows: $95 U.S., $175 Canada, $255 International. Second-class postage paid at Cleveland, OH, and additional mailing offices. Editorial and advertising addresses: ELECTRONIC DESIGN, 611 Route #46 West, Hasbrouck Heights, NJ 07604. Telephone (201) 393-6060. Facsimile (201) 393-0204.

Printed in U.S.A. Title registered in U.S. Patent Office. Copyright © 1993 by Penton Publishing Inc. All rights reserved. The contents of this publication may not be reproduced in whole or in part without the consent of the copyright owner.

Permission is granted to users registered with the Copyright Clearance Center Inc. (CCC) to photocopy any article, with the exception of those for which separate copyright ownership is indicated on the first page of the article, provided that a base fee of $1 per copy of the article plus $.50 per page is paid directly to the CCC, 27 Congress St., Salem, MA 01970 (Code No. 0013-4872/93 $1.00 + .50). (Can. GST #R126431964) Copying done for other than personal or internal reference use without the express permission of Penton Publishing, Inc. is prohibited. Requests for special permission or bulk orders should be addressed to the editor.

For subscriber change of address and subscription inquiries, call (216) 696-7000.

POSTMASTER: Please send change of address to ELECTRONIC DESIGN, Penton Publishing Inc., 1100 Superior Ave., Cleveland, OH 44114-2543.

FAST CMOS FLASH A/Ds

Micro Networks Can Solve Your Application Puzzle with the Industry's Fastest CMOS Flash A/D Converters.

MN5909
100MHz
34dB SINAD
43dB SFDR
200mW Power

MN5906
50MHz
35dB SINAD
44dB SFDR
225mW Power

FEATURES

- 6-Bit Resolution
- +5V Supply Operation
- T/H Not Required
- DIP and SOIC Packaging
- Commercial, Industrial and Military Models

Call or FAX for FREE Samples or Product and Applications Information for Our CMOS Flash A/D Converters.

Maximum Performance Minimum Power

Micro Networks is an ISO-9001 "Registered Firm"

nsai
I.S./ISO 9001/EN 29001

MICRO NETWORKS
324 Clark Street
Worcester, MA 01606
Tel (508) 852-5400
Fax (508) 853-8296

CIRCLE 154 FOR U.S. RESPONSE
CIRCLE 155 FOR RESPONSE OUTSIDE THE U.S.

ELECTRONIC DESIGN 40 YEARS AGO

Memory unit for installation in a computer

Model 3C1-384 is a Memory Unit designed as a complete package ready for installation in a computer. Composed of a solid acoustic delay line and associated circuitry, the unit is specially fitted for airborne use and is insensitive to shock.

The design includes the entire memory circuit in one plug-in type chassis. Groups of these units can be used in a computer for sufficient memory, and a complete memory circuit can easily be removed for servicing and a spare unit plugged in to keep the computer operating. The unit stores 384 bits at a pulse repetition rate of 1Mc, and a self-contained heating element and thermal control give temperature stability to the quartz line. Inherent accuracy of delay control greatly exceeds design requirements.

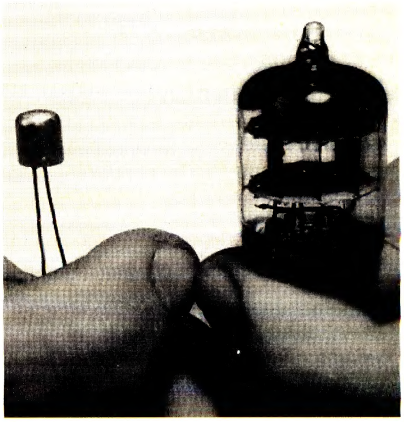
All germanium diodes are grouped in a single plug-in type sub-unit, and all five tubes are 6AN5's operated 80% below the manufacturers' design center. The input voltage requirement into the write-erase gate is 10v. Further specifications include a reshaped output signal level 15v into a 100 ohm impedance load; a carrier frequency of 20Mc; and a temperature coefficient for the quartz delay line—123 parts per million per degree C. Computer Control Co., Dept. ED, 106 Concord Ave., Belmont 78, Mass.. *(Electronic Design, September 1953, p. 27.)*

Acoustic delay lines were basically serial memories in which the quartz medium propagated the pulses as acoustic, or mechanical, disturbances. External counting circuits kept track of the serial "addresses" of the individual pulses and gated them to a register when they arrived at the delay-line output. This memory, which held only 384 bits, is another example of a well-engineered system that was rendered obsolete by better technologies.—Ed.

Silicon alloy junction diode

A new silicon alloy junction diode (developed by Bell Telephone Laboratories) compared with a miniature vacuum diode at the right. The unit has a reverse current rating of 5µµamp at 10v. Its reverse resistance of 2,000,000 megohms compares with 10 megohms at 10v for some germanium diodes. Applications include switching and in memory circuits of a transistor-operated digital computer where its high back resistance is especially useful. (*Electronic Design, September 1953, p. 6.)*

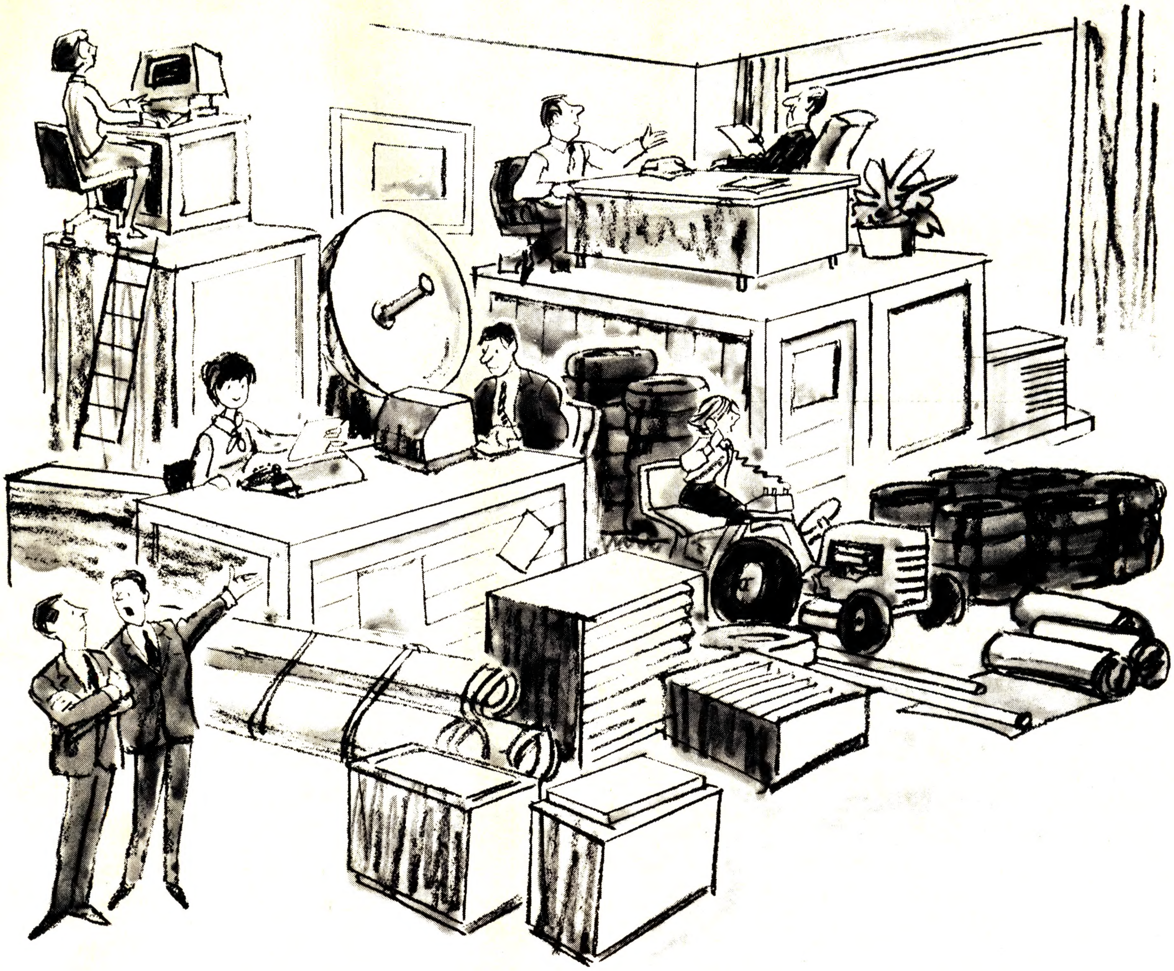
In late 1953, silicon was just beginning to displace germanium as the primary material for semiconductor devices. Bell Labs, as well as Texas Instruments, were major contributors to such technology. (Of course, today, instead of 5µµamp, we'd call the current 5 picoamps, just as we use picofarads rather than micromicrofarads, or "micromikes," as they were often called in the early 50s.)—Ed.



Ultra-miniature transformer for transistor audio applications

An ultra-miniature transistor transformer has been added to the company's line. Designed primarily for transistor audio applications, the device also can be used wherever low power is involved. Weighing less than 1/10 oz., the unit measures 1/4" x 3/8" x 3/8" and is about the same size as the transistor it is designed to power. Useful below 1mw level, it is constructed of extremely fine wire and wound on molded nylon bobbins, with special nickel alloy steel laminations. Standard Transformer Corp., Dept. ED, 3580 Elston Ave., Chicago 18, Ill. *(Electronic Design, September 1953, p. 35.)*

These types of transformers are unusual in that they have changed little over the past four decades. Today's miniature transformers may be made with surface-mounted terminals, but otherwise they are basically the same as they were 40—or more—years ago.—Ed.



"Do you ***really*** *want to make Vice President, Fenton?*
Get rid of this excess inventory...pronto."

CALL EAL IF YOUR CORPORATION HAS MATERIAL AVAILABLE FOR DONATION.

EAL - Will take your donated material and use it to generate scholarships for needy, deserving students.

EAL - Donations could mean an above cost tax deduction - IRS Reg.170(E)(3)

EAL - Scholarships are given in the donating corporation's name.

EAL - Leverages your gift to help participating colleges.

EAL
Educational Assistance Ltd. SM
P.O. Box 3021 • GLEN ELLYN, ILLINOIS 60138

For More Details
Call 708-690-0010
Peter Roskam
Executive Director

SCSI PORTABLE ANALYZER / EMULATOR

- SCSI 1&2
- SCSI 3 Parallel
- FAST & WIDE
- SCSI Initiator Emulator
- Single-Ended or Differential (optional)
- Tracing over 10Mhz with 20 nsec time stamp resolution
- Applications: development, production, field service

☎ (415)322-5322 FAX: (415)322-0455
115 Constitution Dr., Menlo Park, California 94025 USA

BASICS OF SCSI BOOK AVAILABLE FREE!

ANCOT CORPORATION

CIRCLE 88 FOR U.S. RESPONSE
CIRCLE 89 FOR RESPONSE OUTSIDE THE U.S.

WHERE QUALITY MEETS AFFORDABILITY

WIDE RANGE INPUT SWITCHERS

- 85-264V AC universal input
- 30/40/65/110W output power
- Single to quad outputs
- Compact footprints
- Low profile on 30/40W series (1.2" in height)
- Available in PCB/L-B/BOX

TABLETOP POWER SUPPLIES

- 85 to 264V AC universal input
- Compact size & light weight
- Up to 55W output power
- Built-in EMI filter
- Input surge current protection
- Overvoltage/current protection
- Circular DIN or hollow co-axial
- UL/CSA/TUV approved

Call for custom applications

FORTRON/SOURCE

2925 Bayview Dr.
Fremont, CA 94538
Tel: (510) 440-0188
Fax: (510) 440-0928

CIRCLE 120 FOR U.S. RESPONSE
CIRCLE 121 FOR RESPONSE OUTSIDE THE U.S.

ELECTRONIC DESIGN

Editor-in-Chief: Stephen E. Scrupski

Executive Editor: Roger Allan

Managing Editor: Bob Milne

Senior Editors: Frank Goodenough, Milt Leonard, John Novellino

Technology Editors:
Advanced Technology: Jack Shandle
Analog & Power: Frank Goodenough
Communications & Industrial: Milt Leonard (San Jose)
Components & Packaging: David Maliniak
Computer-Aided Engineering: Lisa Maliniak
Computer Systems: Richard Nass
Semiconductors: Dave Bursky (San Jose)
Software: Sherrie Van Tyle
Test & Measurement: John Novellino
London: Peter Fletcher
To contact, call or write:
611 Route 46 West
Hasbrouck Heights, NJ 07604
(201) 393-6262 or (201) 393-6270
Fax (201) 393-0204

News Editor: Clifford Meth

Field Correspondents:
West Coast Executive Editor: Dave Bursky (San Jose)
Communications & Industrial: Milt Leonard (San Jose)
To contact, call or write:
2025 Gateway Plaza, Suite 354
San Jose, CA 95110
(408) 441-0550

Chief Copy Editor: Roger Engelke Jr.

Contributing Editors:
Ron Kmetovicz, Robert A. Pease

Editorial Production Manager:
Pat A. Boselli
Production Coordinator: Wayne M. Morris

Group Art Director: Peter K. Jeziorski

Associate Art Director: Tony Vitolo

Staff Artist: Tom Pennella

Editorial Support Supervisor:
Mary James

Editorial Assistant: Ann Kunzweiler

Editorial Secretary: Bradie Guerrero

Vice President-Editorial: Perry Pascarella

Advertising Production:
(201) 393-6093 or Fax (201) 393-0410

Production Manager: Mike McCabe
Assistant Production Manager:
Eileen Slavinsky
Production Assistants:
Lucrezia Hlavaty, Joyce Borer

Circulation Manager: Susan Brown

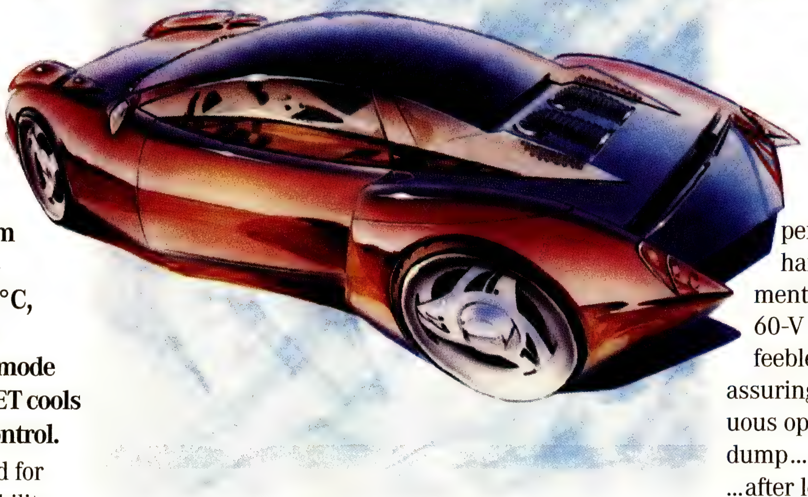
Reprints: Anne Adams
Penton Reprints 1-800-659-1710

Published by Penton Publishing

Publisher: John R. Carroll

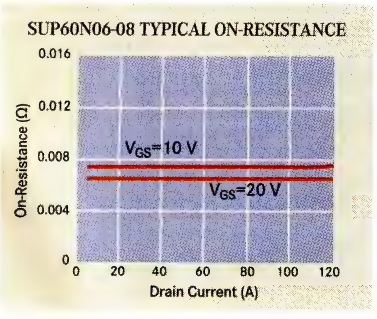
What do you get with Siliconix' new 60-V, 8-mΩ MOSFET?

COOLER ELECTRONICS FOR HOTTER CARS.



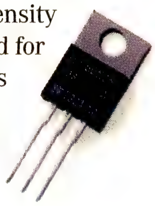
With maximum junction temperature of 175°C, this n-channel enhancement-mode TO-220 MOSFET cools down motor control. It's unsurpassed for improving reliability and reducing part count. And has been funded in part by Daimler-Benz as an ideal motor control solution for HVAC, memory seat systems, and electric power steering. It can also be used in uninterruptible power supplies for computers.

Lower on-resistance for higher reliability.



The rugged SUP60N06-08, with its guaranteed 8-mΩ maximum on-resistance and 175°C maximum junction temperature, will reduce power dissipation and enhance performance in the harshest of environments. This is a robust 60-V solution, not a feeble 50-V product, assuring you of continuous operation, load dump...after load dump ...after load dump.

Unparalleled part count reduction.



Produced with Siliconix' new ultra-high density technology, this device eliminates the need for heatsinks and makes paralleling MOSFETs obsolete – use it to replace three industry-standard TO-220s and shrink your system size and cost.

Create cooler car electronics.

Contact your local Siliconix/TEMIC sales office. Or call our toll-free hot line now! **1-800-554-5565, ext. 591.** Ask for your SUP60N06-08 Design Kit, including SPICE model and free sample.

Siliconix
A Member of the TEMIC Group

TEMIC/Siliconix U.S. Headquarters: 2201 Laurelwood Road, Santa Clara, CA 95056 Fax: (408)970-3950, Attn. 43-591. © Copyright 1993 Siliconix inc.
TEMIC International Sales: UNITED KINGDOM: (0344)485757. **GERMANY:** (07131)670. **FRANCE:** (1)30.60.70.00. **ITALY:** (02)489-52258.
SCANDINAVIA: 08-733-0090. **SINGAPORE:** 65-7886668 ext. 249. **HONG KONG:** 852-724-3377. **JAPAN:** 3-3578-0823.

The future has to start somewhere.

We predict it will start in very close proximity to Motorola's PowerPC™ Microprocessors.

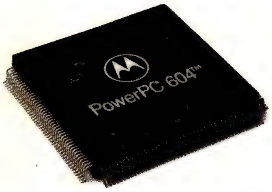
Here's why. Personal computers are on the verge of becoming infinitely more useful, more usable, more communicative and more mobile than they are today. A number of advanced technologies—real-time video, wireless networks, voice and handwriting recognition and object-oriented programming, among many others—are ripening, converging and becoming affordable all at once.

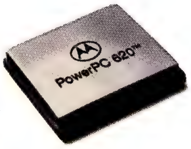
The one thing all those technologies need is extraordinary processing power. Processing power that only PowerPC Microprocessors can deliver.

In its various forms, the PowerPC microprocessor will provide the right combinations of

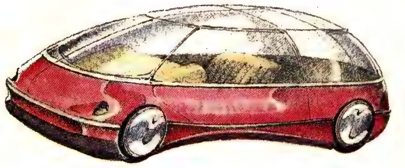
POWERED BY
MOTOROLA

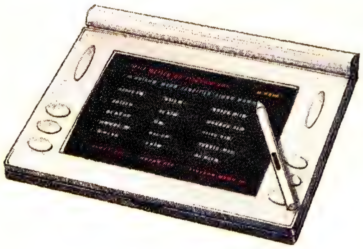
©1993 Motorola, Inc. Motorola and Ⓜ are registered trademarks of Motorola, Inc. PowerPC, PowerPC 601, PowerPC 603, PowerPC 604, PowerPC 620 and the PowerPC logo are trademarks of IBM Corporation. All rights reserved.

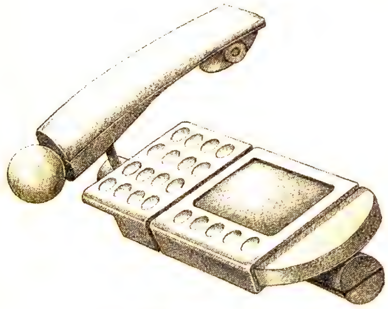


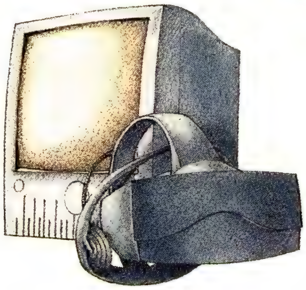


Motorola's family of PowerPC microprocessors will serve computing needs from hand-held computers to supercomputers. The PowerPC 601™ Microprocessor, 60-80 SPECmarks, is designed for high performance, low-cost personal computers. The PowerPC 603™ Microprocessor is a low-wattage microprocessor perfect for battery-powered hand-held and other mobile computers. The PowerPC 604™ Microprocessor is a high-performance microprocessor for high-end PCs workstations and servers. The ultra-high performance PowerPC 620™ Microprocessor, 200-400 SPECmarks, is right for high-end workstations, servers and supercomputers.









high performance, small size, low power consumption and low price that make it the only real choice for an incredible variety of applications. From massively parallel central servers, desktop computers and pocket-sized digital notepads to voice/data communications systems and automotive control units.

To take a closer look at the future of computing, call your local Motorola sales office or in Europe call (44) 3552 40446. We'll be happy to provide you with more information, including our free PowerPC Information Pack.

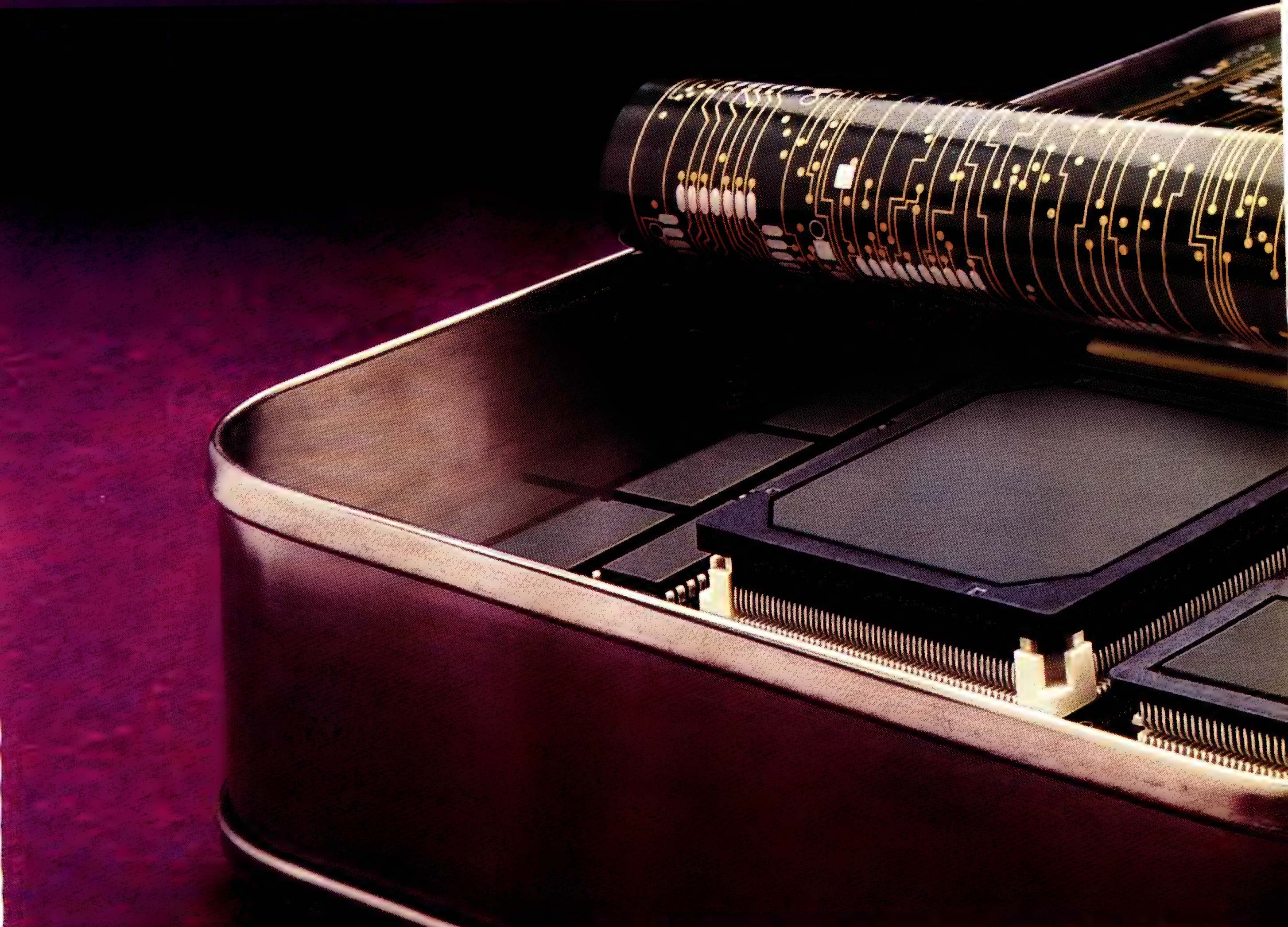
The future of computing is going to be very different. That difference will be powered by PowerPC Microprocessors from Motorola.

PowerPC Microprocessors. *Changing the course of computing. For the better.*

MOTOROLA

CIRCLE 262 FOR U.S. RESPONSE
CIRCLE 263 FOR RESPONSE OUTSIDE THE U.S.

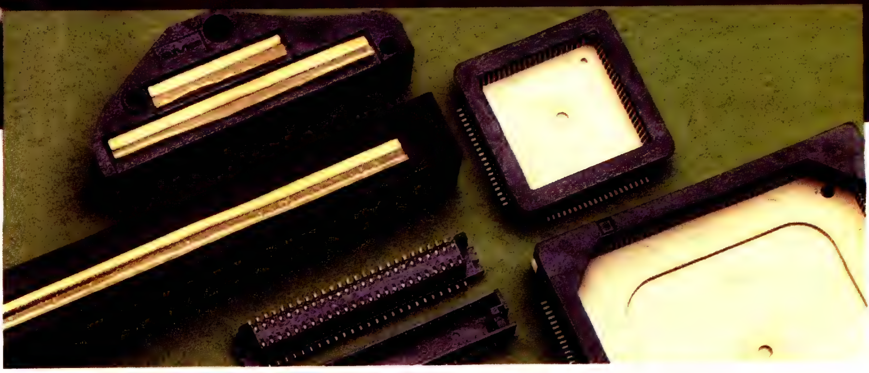
How to beat the squeeze in today's tight design environments.



High-density design is a world unto itself — a world with tight corners, low ceilings, and shrinking floors. Living there on today's budgets and schedules can be a lot easier with help from the experts. In interconnects, that's us.

Because every design is unique, we'll show you all the options. We can guide you through the good and bad of each — with an eye on system performance, manufacturability, and cost.

We'll show you all the choices you have, too, in socketing, I/O, and board-to-board interconnects. With systems that range from the conventional (0.050" and 2mm centers) to the sublime (our "finest" connectors offer redundant contact on board pads 0.015" wide, on 0.025" centers, with non-critical alignment). We'll make sure the



AMP fine-pitch solutions are available for designs requiring sub-0.050", sub-2mm centers. Metristak board-to-board stacking connectors on 1mm centers; LGA, MCR, and PQFP sockets; FPC connectors on 1mm and 0.5mm centers; AMPLIFLEX elastomeric package- and board-to-board connectors for pitches as fine as 0.025".

AMP and AMPLIFLEX are trademarks

system you work with can meet tight electrical characteristics as well as tight space limitations.

And we'll show you how the system you choose will fit successfully into production. With the packaging you need. The tooling and feeder modules you need. And the support you need in training and maintenance.

Need more help? We supply full technical information, catalog sheets, and 2D and 3D models of many product lines to shorten your design cycle. And we can provide design services, build your subsystems, or even fabricate all of your product for you.

For more information, call the AMP Information Center near you.

Scandinavia:
Sweden 46-8-580-833-00
(fax 46-8-580-194-70)

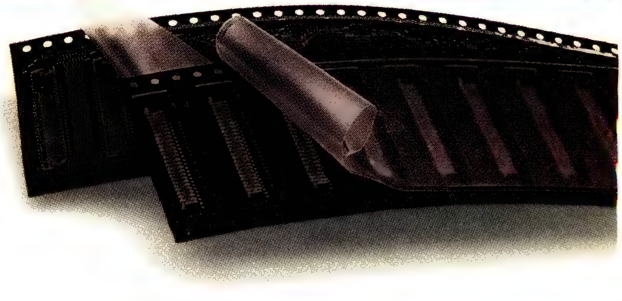
Central Europe:
Holland 31-73-20-0911 (fax 31-73-21-2365)
Germany 49-6103-7090 (fax 49-6103-709223)
Great Britain 44-1-954-2356 (fax 44-1-954-6234)

Southern Europe:
France 33-1-34-43-2720 (fax 33-1-30-30-4550)
Italy 39-11-7173-1 (fax 39-11-403-1116)
Spain 34-3-200-8466 (fax 34-3-201-7879)

THIS IS AMP TODAY.

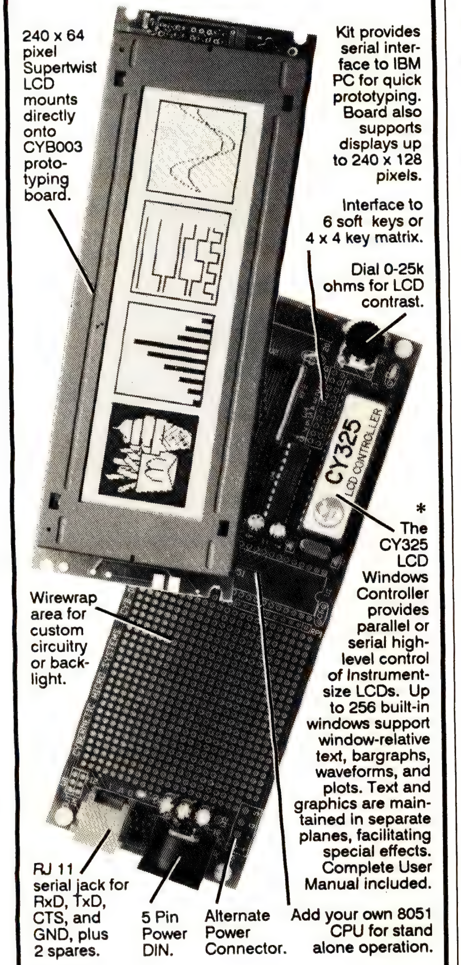
AMP

CIRCLE 246 FOR U.S. RESPONSE CIRCLE 247 FOR RESPONSE OUTSIDE THE U.S.



LCD Proto Kit

Everything you need to start your LCD application .... create complex screens in just a few hours!


240 x 64 pixel Supertwist LCD mounts directly onto CYB003 proto-typing board.
Kit provides serial inter-face to IBM PC for quick prototyping. Board also supports displays up to 240 x 128 pixels.
Interface to 6 soft keys or 4 x 4 key matrix.
Dial 0-25k ohms for LCD contrast.
CY325 LCD CONTROLLER
* The CY325 LCD Windows Controller provides parallel or serial high-level control of Instrument-size LCDs. Up to 256 built-in windows support window-relative text, bargraphs, waveforms, and plots. Text and graphics are main-tained in separate planes, facilitating special effects. Complete User Manual included.
Wirewrap area for custom circuitry or back-light.
RJ 11 serial jack for RxD, TxD, CTS, and GND, plus 2 spares.
5 Pin Power DIN.
Alternate Power Connector.
Add your own 8051 CPU for stand alone operation.

Kit also includes:

Power supply provides +5v and Gnd for board, -12v for LCD, and +12v spare.
Sample routines in 8051 Assembler and QuickBasic.
LCD Paint™ for creating your own graphics images.
4-wire RJ11 style cable with DB25F connector for your IBM PC.
LCD demo
Demo routines preprogrammed into 8751 for immediate gratification.

$495 - Kit
Popular LCD Starter Kit.

MC VISA AMEX

($595 pre-assembled & tested)

*The CY325 CMOS 40-pin DIP and 44-pin PLCC LCD Controller IC are available from stock @ $75/singles, $20/1000s.

CyberneticMicroSystems
Box 3000 • San Gregorio CA 94074
Tel: 415-726-3000 • Fax: 415-726-3003

CIRCLE 270 FOR U.S. RESPONSE
CIRCLE 271 FOR RESPONSE OUTSIDE THE U.S.

RECYCLING PAYS—EXCEPT FOR ACRONYMS

Everyone has pet peeves. One of mine, which seems to be growing in intensity, is an acronym that uses new words for an old letter combination. It seems that many established letter combinations are being recycled to denote new things. For example, it wasn't so long ago that "ATM" was coined to represent "automatic teller machine." We frequently encountered the term both in our professional lives, discussing distributed computing systems, and in our personal lives, as a source of ready cash, day or night. But now it means "asynchronous transmission mode" in communications parlance.

These new meanings just don't seem fair, because once an acronym becomes familiar, it evokes a mental response in which we supply the words that the acronym represents, just as you can't stop yourself from supplying the words of a song whenever you hear the melody. Now, when you hear some of these new/old acronyms, you have to stop and remind yourself that you're dealing with a new acronym.

When someone refers to ATM in the communications realm, I can't help but think of that friendly cash machine. One would presume that whoever comes up with these things would have the sense to at least pick a new combination of letters. Rather than aid communications, such recycling throws up new stumbling blocks to understanding.

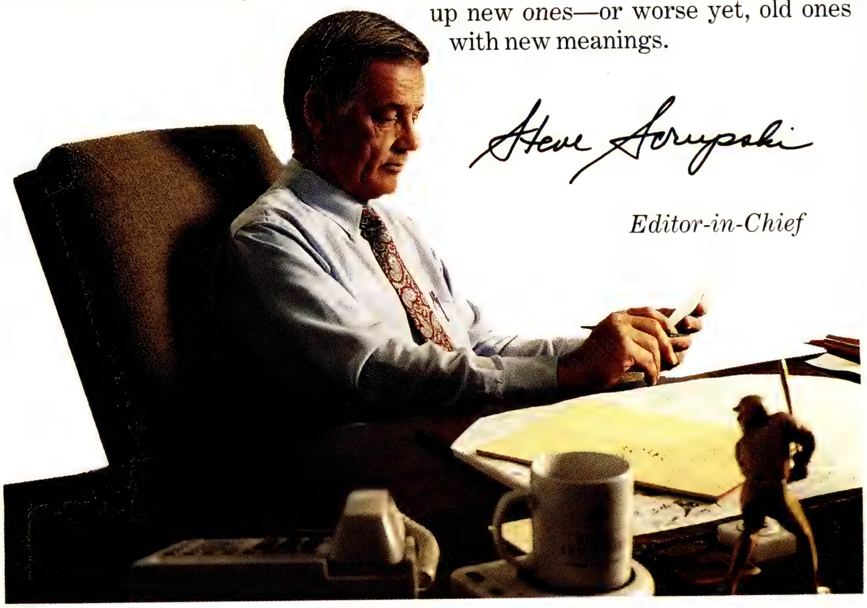
Another dual-meaning acronym is "EMF," which always meant electromotive force to me, as in a battery or the back-voltage generated by a motor's rotating member. Now the term has been wrenched away from strictly technical literature and given to the public to describe the ongoing controversy surrounding the effects on humans of power-frequency electromagnetic fields. (Side note: The July 8 issue Editorial, which called for more study on these nouveau EMFs, drew a large reader response. Many of the letters are published in this issue's Readers' Comments section, p. 190).

Apparently the only acronyms immune to reuse are those under legal protection. Otherwise, for example, "intercontinental ballistic missile" wouldn't have picked up a "C."

The editors of *Electronic Design* have assembled a long, long list of acronyms collected over the past few years. As soon as one of us can go off-line for a while and get the list in shape, we will print it and then ask readers if they have any other entries to add. Of course, the list will be obsolete the day it's published because those at the alphabet-soup factory, wherever it's located, keep stirring up new ones—or worse yet, old ones with new meanings.

Steve Scrupski

Editor-in-Chief



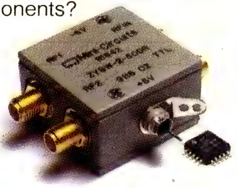
SPDT switches with built-in driver

ABSORPTIVE or REFLECTIVE dc to 5GHz

Truly incredible…superfast 3nsec GaAs SPDT reflective or absorptive switches with built-in driver, available in pc plug-in or SMA connector models, from only $14.95. So why bother designing and building a driver interface to further complicate your subsystem and take added space when you can specify Mini-Circuits' latest innovative integrated components?

Check the outstanding performance of these units…high isolation, excellent return loss (even in the "off" state for absorptive models) and 3-sigma guaranteed unit-to-unit repeatability for insertion loss. These rugged devices operate over a -55° to +100°C span. Plug-in models are housed in a tiny plastic case and are available in tape-and-reel format (1500 units max, 24mm). All models are available for immediate delivery with a one-year guarantee.

CIRCLE 158 FOR U.S. RESPONSE



SPECIFICATIONS (typ)	Absorptive SPDT YSWA-2-50DR ZYSWA-2-50DR			Reflective SPDT YSW-2-50DR ZYSW-2-50DR		
Frequency (MHz)	dc-500	500-2000	2000-5000	dc-500	500-2000	2000-5000
Ins. Loss (dB)	1.1	1.4	1.9	0.9	1.3	1.4
Isolation (dB)	42	31	20	50	40	28
1dB Comp. (dBm)	18	20	22.5	20	20	24
RF Input (max dBm)	——	20	——	22	22	26
VSWR "on"	1.25	1.35	1.5	1.4	1.4	1.4
Video Bkthru (mV,p/p)	30	30	30	30	30	30
Sw. Spd. (nsec)	3	3	3	3	3	3
Price, $ (1-9 qty)	YSWA-2-50DR (pin) 23.95 ZYSWA-2-50DR (SMA) 69.95			YSW-2-50DR (pin) $14.95 ZYSW-2-50DR (SMA) 59.95		

finding new ways…
setting higher standards

CIRCLE 159 FOR RESPONSE OUTSIDE THE U.S.

Mini-Circuits™

WE ACCEPT AMERICAN EXPRESS AND VISA

P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661

Distribution Centers/NORTH AMERICA 800-654-7949 • 417-335-5935 Fax 417-335-5945 EUROPE 44-252-835094 Fax 44-252-837010

For detailed specs on all Mini-Circuits products refer to • THOMAS REGÍSTER Vol. 23 • MICROWAVES PRODUCT DIRECTORY • EEM • MINI-CIRCUITS' 740-pg HANDBOOK

WHO

Who made the great monoliths on Easter Island?

Nobody knows.

ISO9001
Certified

Certificate No FM24651

■ SEMICONDUCTOR BUSINESS
SALES & MARKETING DIV.: JOONG-ANG DAILY NEWS BLDG., 7, SOONWHA-DONG, CHUNG-KU, SEOUL, KOREA| TEL: 751-6114 FAX: 751-6061
SAMSUNG SEMICONDUCTOR INC. (USA, SANJOSE): TEL: (408) 954-7000 FAX: (408) 954-7873| **HONGKONG BRANCH:** TEL: 3626900 FAX: 8661343
TAIWAN BRANCH (TAIPEI): TEL: (2) 757-7292 FAX: (2) 757-7311 **SAMSUNG ELECTRONICS JAPAN CO., LTD. (TOKYO):** TEL: (03) 5641-9850
FAX: (03) 5641-9851 **SAMSUNG SEMICONDUCTOR EUROPE GMBH (FRANKFURT):** TEL: 0049-6196-90090 FAX: 0049-6196-900989
SINGAPORE PTE LTD.: TEL: 535-2808 FAX: 227-2792

Who makes the fastest 1M Fast SRAM in the world?

SAMSUNG

It's been a major effort. But in a brief span of time, Samsung has made quite an ascent.

In the significant SRAM area, Samsung is now among the leaders.

And the first company worldwide to equal the top BiCMOS speed standard. Which gives you, for the first time, an alternate source for 1-meg SRAMs at a blazing 10ns.

As a reliable, high-volume supplier, we're going to do a lot for your ability to design new products.

We'll follow the 10ns part with an even greater accomplishment — the world's first 1-meg at 8ns.

At Samsung, we're proud to be part of these advancements. And proud to extend the leadership we earned with the world's first 16-meg DRAM.

What we've done in SRAMs has been widely noticed, and we've become a supplier of choice to many of the major systems companies. Now, you can choose Samsung as your partner.

FAST SRAM FAMILY

Density	Part Name	Org.	Access Time (ns)	Package	Availability	Remarks
4M	KM644002	1M x 4	15/20/25	SOJ(R)	'93,2Q	
	KM684002	512K x 8	15/20/25	SOJ(R)	'93,2Q	
	KM6164002	256K x 16	20/25	SOJ(R)	'93,3Q	
	KM64V4002	1M x 4	20/25	SOJ(R)	'93,2Q	3.3V
	KM68V4002	512K x 8	20/25	SOJ(R)	'93,2Q	3.3V
	KM616V4002	256K x 16	25	SOJ(R)	'93,3Q	3.3V
1M	KM64B1003	256K x 4	10/12	SOJ(R)	NOW	BiCMOS
	KM68B1002	128K x 8	10/12	SOJ(R)	NOW	BiCMOS
	KM641003	256K x 4	15	SOJ(R)	NOW	
	KM681002	128K x 8	15	SOJ(R)	NOW	
	KM6161002	64K x 16	15	SOJ(R)	NOW	
	KM64V1003	256K x 4	15	SOJ(R)	'93,3Q	3.3V
	KM68V1002	128K x 8	15	SOJ(R)	'93,3Q	3.3V
	KM616V1002	64K x 16	15	SOJ(R)	'93,3Q	3.3V
	KM741006	256K x 4	10/12.5	SOJ(R)	NOW	Syn.

(R): Revolutionary Pin Configuration

Low Power SRAM FAMILY

Density	Part Name	Org.	Access Time (ns)	Package	Availability	Remarks
4M	KM684000	512K x 8	55/70/85/100	DIP/SOP/TSOP	NOW	
	KM684000-V	512K x 8	75/85/100	DIP/SOP/TSOP	NOW	3.3V
	KM658512	512K x 8	80/100	SOP/TSOP	NOW	Pseudo
1M	KM681000	128K x 8	70/85/100	DIP/SOP/TSOP	NOW	
	KM658128	128K x 8	80/100	DIP/SOP	NOW	Pseudo

TECHNOLOGY
THAT WORKS
FOR LIFE

SAMSUNG
ELECTRONICS

CIRCLE 198 FOR U.S. RESPONSE

CIRCLE 199 FOR RESPONSE OUTSIDE THE U.S.

LEADERSHIP IN THERMISTOR TECHNOLOGY

Keystone

MINIATURE SENSORS

±1°C accuracy

- Rugged design, epoxy insulated body and Teflon insulated leads
- Dissipation constant of 1.4 mW/°C
- Time constant of 15 seconds
- Operating range from – 50° to +150°C
- Temperature accuracy of ±1°C @ 25°C
- Just over one inch long overall

R₀ @ 25°C	Temp. Coef. %/°C @ 25°C	Material
2K	–3.83	MS 73
5K	–4.43	MS 95
10K	–4.40	MS 97
30K	–4.32	MS 96
50K	–4.84	MS120
100K	–4.78	MS122

Other resistance values available.

Send for more information.

Keystone CARBON COMPANY

Thermistor Division • St. Marys, PA 15857
Phone 814-781-1591 • Fax 814-781-7648

Keystone Thermistors are distributed by

Allied Electronics	1-800-433-5700
Newark Electronics	1-800-367-3573
Digi-Key Corporation	1-800-344-4539
Dexter Corporation	1-800-345-4082
Summit Distributors	1-800-678-6648

CIRCLE 272 FOR U.S. RESPONSE
CIRCLE 273 FOR RESPONSE OUTSIDE THE U.S.

DATABOOKS GO ELECTRONIC

No matter how sharp today's designers may be, they're having difficulty coping with an information explosion. Utter frustration can set in because, while searching through shelves of manufacturer's databooks to find the right device for a specific task, designers often run into inaccurate and outdated component information. Furthermore, when they must coordinate with other groups within the organization, which means sharing component data that can change, the process drags on further.

The complexity of modern system design has forced most designers to rely on computers for their work, thus data in an electronic format is much more logical than a fistful of papers. Rather than go through the arduous job of feeding the device's specifications to the design tools, several independent technical-information services are emerging to help designers conquer the problem with component data directly in electronic form, which in some cases will be compatible with commonly used EDA tools.

The electronic approach to disseminating component data accomplishes several goals. By exploiting network connectivity, it can reach many designers to ensure they're armed with the proper information. Moreover, because it eliminates the time lag imposed by manufacturers having to publish data in a catalog and then physically get it into designers' hands, design teams are working with current data.

LISA MALINIAK
COMPUTER-AIDED ENGINEERING

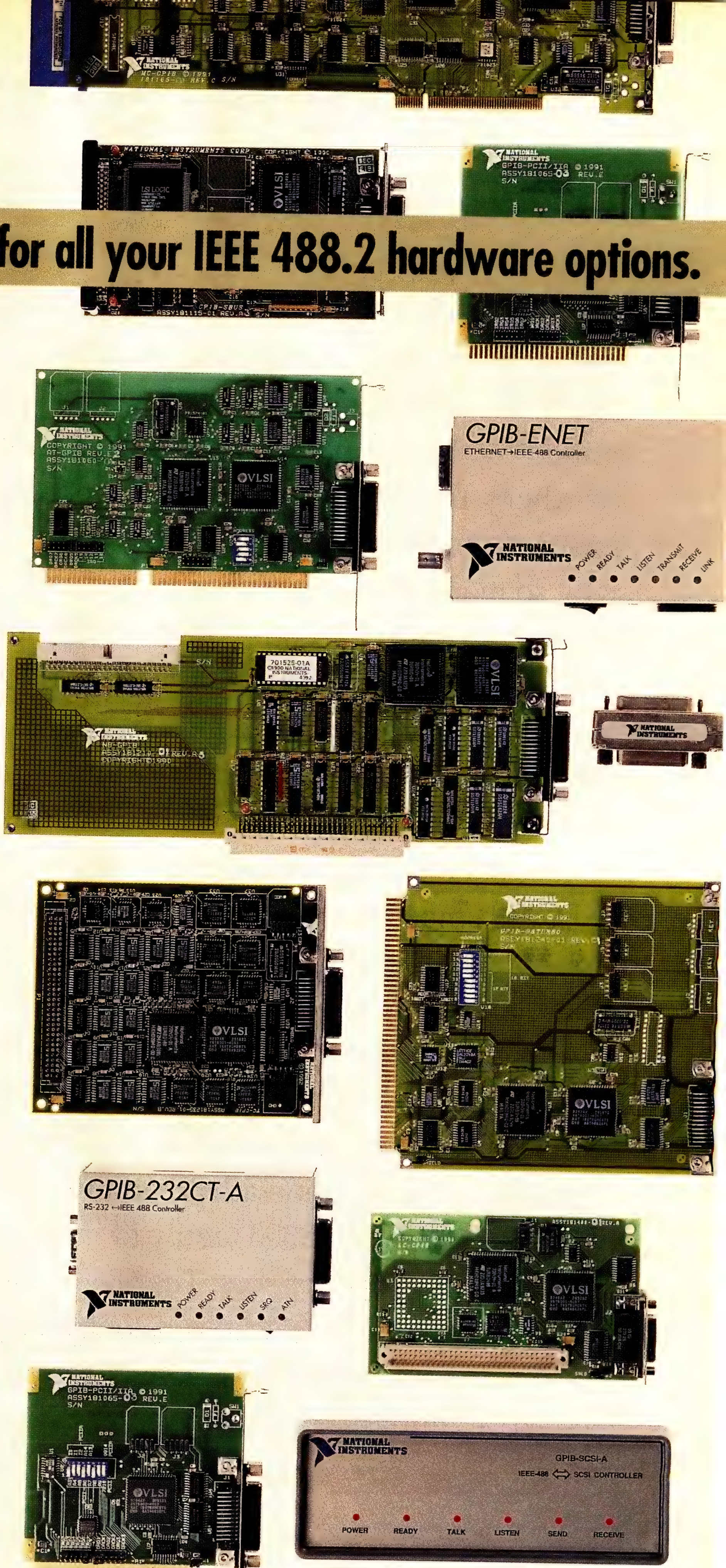
Although many manufacturers now offer datasheets and catalogs in electronic formats such as floppies and CD-ROMs, the emerging information services constitute a kind of clearing house that can help the designer comparison-shop among several competing vendors. Aspect Development Inc., Los Altos, Calif., for example, offers the Component Reference Databases, which contain information for more than one million ICs and discrete semiconductors from manufacturers worldwide. The Reference Databases are composed of manufacturer-datasheet images on CD-ROMs. Users can view more than 600,000 datasheet pages on a computer screen, allowing immediate access to timing diagrams and other device data. The database can be searched using any number of parameters recorded for each component, including manufacturer, semiconductor technology, and electrical specifications. Aspect is also developing CIS databases for resistors, capacitors, and other components. Updates are available every 60 days.

The engineering-information service created by Info Enterprises Inc., a Motorola Co., Chandler, Ariz., is dubbed EnGenius. It's a compilation of product information from electronic-component manufacturers around the world that's available as an on-line database. As manufacturers update the database in real time, EnGenius notifies users of changes to products they selected as well as new products. EnGenius locates information using various criteria, including parametric, hierarchical, and part-number searches. Users can then view and print, or copy and paste, information into their designs.

Viewpoint Information Systems Inc., Waltham, Mass., offers an electronic-component library. The ViewPoint Component Library consists of a machine- and human-readable database of product specifications sourced directly from semiconductor vendors. It creates a digital product-information link from the supplier to the designer, and bypasses the costlier, slower distribution of printed information and manual data entry. The library, which is distributed through an agreement with Mentor Graphics Corp., Wilsonville, Ore., has updates sent out to subscribers over the Internet worldwide network.

There's a certain irony to the fact that the electronics industry is only now beginning to avail itself of the information technology it's worked so long and hard to create. Nevertheless, new forms of data delivery can only help reduce the time-to-market and product-quality pressures facing designers.

One software... for all your IEEE 488.2 hardware options.



Taking advantage of new and changing computer technologies is a requirement in today's test and measurement environment. To do so, you must be able to transfer your GPIB software programs easily between platforms. Our industry-standard NI-488.2™ software gives you the software portability that makes this transfer possible.

You can easily port NI-488.2 programs from one computer platform to another. Our IEEE 488.2-specified NI-488.2 routines and the traditional NI-488® functions have the same parameters and syntax on all computer architectures and operating systems.

And, the NI-488.2 software takes full advantage of our high-performance NAT4882® chip on our interface boards for the PC AT, Micro Channel, NEC, SBus, NuBus, and TURBOchannel, as well as our GPIB controller boxes for RS-232, SCSI, and Ethernet.

No one gives you more choices or flexibility. Your software investment is preserved, whatever new computers or new applications may emerge in the future.

Call for a FREE Application Note on How to Port Your NI-488.2 Application (800) 433-3488 (U.S. and Canada)

NATIONAL INSTRUMENTS®
The Software is the Instrument®

Corporate Headquarters
6504 Bridge Point Parkway
Austin, TX 78730-5039
Tel: (512) 794-0100
95 (800) 010 0793 (Mexico)
Fax: (512) 794-8411

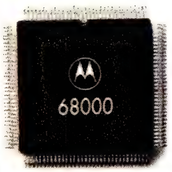
Branch Offices
Australia 03 879 9422 • Austria 0662 435986 • Belgium 02 757 00 20
Canada 519 622 9310 • Denmark 45 76 26 00 • Finland 90 527 2321
France 1 48 65 33 70 • Germany 089 7 14 50 93 • Italy 02 48301892
Japan 03 3788 1921 • Netherlands 01720 45761 • Norway 03 846866
Spain 91 640 0085 • Sweden 08 730 49 70 • Switzerland 056 27 00 20
U.K. 0635 523545

© Copyright 1993 National Instruments Corporation. All rights reserved. Product and company names listed are trademarks or trade names of their respective companies.

CIRCLE 166 FOR U.S. RESPONSE
CIRCLE 167 FOR RESPONSE OUTSIDE THE U.S.

SEE US AT WESCON BOOTH # 7249

Some telecommunica
fine without a Motorola



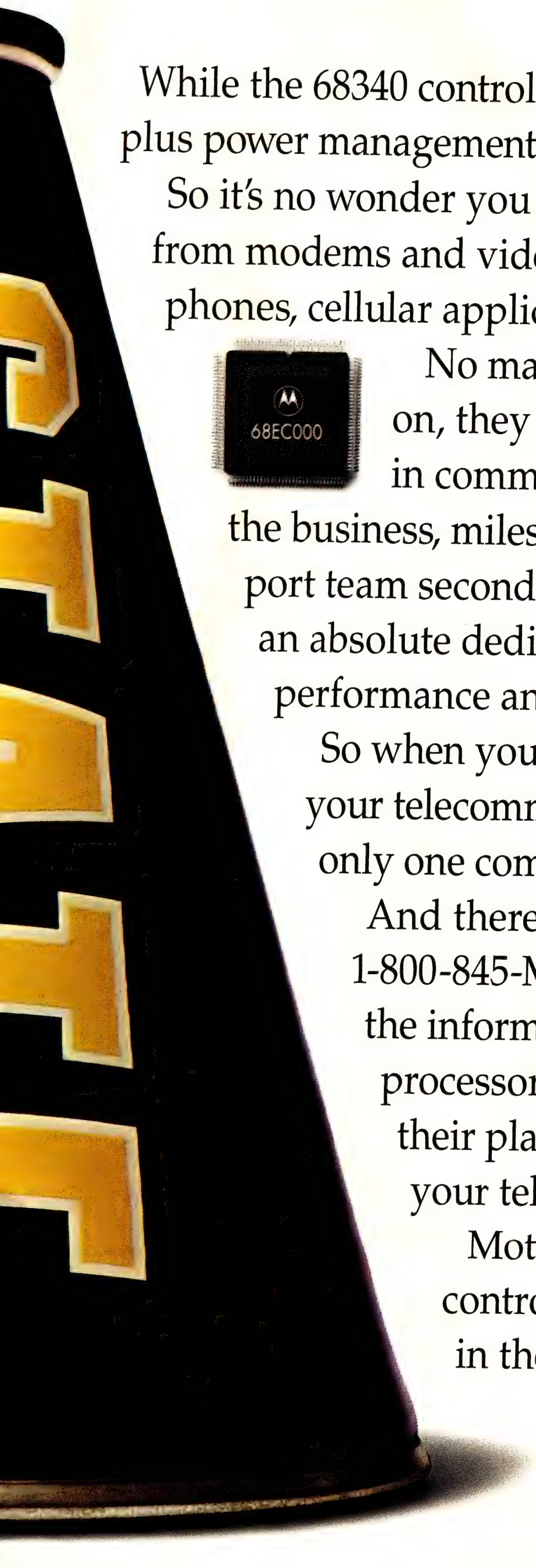
But, frankly, it's hard to recall one. Because Motorola is one of the leading providers of microprocessors to the telecommunications market. A fact best exemplified by the companies we keep—AT&T, Siemens® and Northern Telecom, among others. And once you see the range of unique solutions we offer, it's easy to understand why so many companies choose Motorola.

When it comes to central office equipment, two of our product families get the call. The 68LC040 and 68030 from our CPU family deliver the extreme high performance and reliability that high-capacity digital switches and transmission circuits demand. And our 68EC040 and 68EC030 embedded processors offer a combination of high integer performance and affordability that make them very popular in the PABX arena.

POWERED BY MOTOROLA

At the other end of the telecommunications line (namely, terminating equipment) where integrated peripherals, compact size and low power consumption are paramount, you'll find our 68300 family of integrated microprocessors. The 68302, for instance, provides a specialized controller to handle multiple protocols through its three serial communications channels.

Motorola and the Ⓜ are registered trademarks of Motorola, Inc. Siemens is a registered trademark of Siemens AG. All other company names appearing in this ad are trademarks or registered trademarks of their respective holders. ©1993 Motorola, Inc. All rights reserved.



tions systems work just 68000 microprocessor.

While the 68340 controller offers serial, timers and DMA, plus power management for low-power applications.

So it's no wonder you see (and hear) them in everything from modems and video phones to special function telephones, cellular applications and ISDN devices.

No matter which Motorola chip you decide on, they all have some very important things in common—the best development tools in the business, miles of reusable code, an application support team second to none, our renowned reliability and an absolute dedication to bringing you ever-higher performance and ever-lower costs.

So when you're looking for microprocessors for your telecommunications application, there's really only one company to call. Motorola.

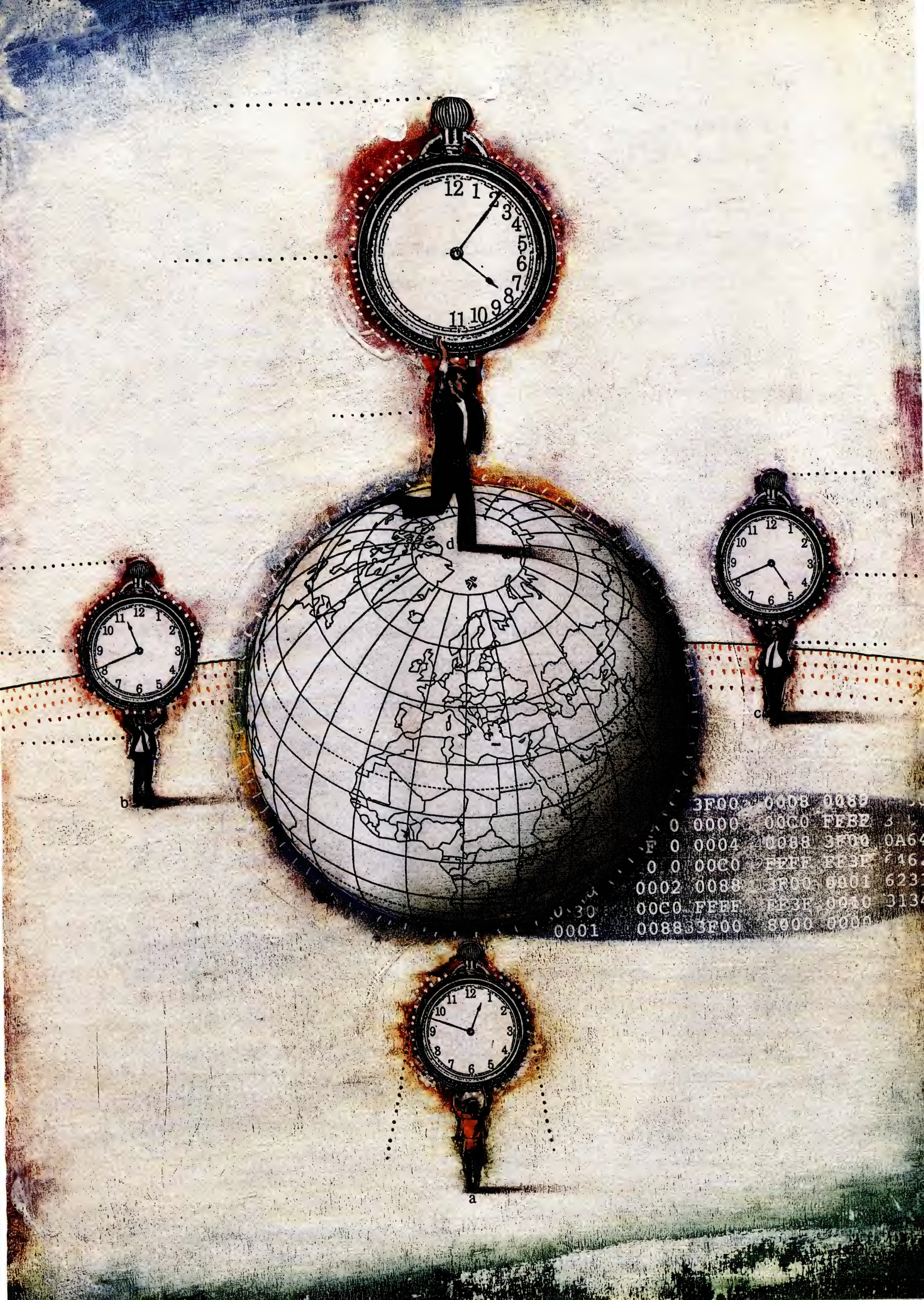
And there's only one number to call as well. 1-800-845-MOTO. We'll provide you with all the information you need on Motorola microprocessors and their place in your telecommunications application.

Motorola 68000. We're in control.

Motorola 68000 32-bit microprocessors control the most innovative products in the world. If yours isn't one of them, perhaps it's time to switch.

MOTOROLA

CIRCLE 162 FOR U.S. RESPONSE CIRCLE 163 FOR RESPONSE OUTSIDE THE U.S.


d
b
c
a

Design information that helps put your product on the map sooner. That's Total Integration.™

Sometimes your greatest competitor is time itself. And in a world where a window of opportunity can shut in a matter of months, one way to beat the clock is to collapse your product development cycle time. Especially at the concept stage where your design need-to-know is greatest.

At Texas Instruments, our concept of Total Integration™ includes the ability to help you do just that. With timely, in-depth information, you can speed up the concept development and preproduction phases of product design simply by being better informed.

One way we're expediting the transfer of design information is through our Electronic Data Interchange (EDI) system. More than 2,000 of our customers worldwide are already taking advantage of the benefits of EDI. Inventory information can also be captured quickly. You can communicate with any TI location. And via EDI, we at TI can access information from all regions of the globe for you.

Always just a phone call away. Whenever you need specific product design assistance, simply call one of our four design centers: Taipei, Seoul, Singapore and Hong Kong. You'll reach real technical experts. They're ready to answer your questions and give one-on-one design help.

A fiber-optics network that spans the globe. With Texas Instruments, on-line exchange of design data and details — from Texas to Taipei — is an everyday event. Because around the world our design centers are linked by a fiber-optics network. Which means the knowledge and expertise you need are readily available. As a matter of fact, we operate one of the industry's largest private worldwide communications networks, which enables us to bring our best design talent to you no matter where you may be.

When only face-to-face will do. You are cordially invited to join the thousands of customers who attend our technical training courses and product seminars. It's a unique opportunity to learn about our newest devices. To provide insight into applications. And to familiarize yourself with the progressive design tools and environments that can extend your reach.

In addition, you will find knowledgeable staff ready and willing to help in any of our nine Asian sales offices.

It's all within easy reach. Moving to the next level of integration quicker. Then, reaching your market sooner. That's what our concept of Total Integration is all about. And it's backed by information, world-class silicon, open development tools and top-notch talent. All brought together to extend your reach.

To find out more, call the sales office nearest you.

EXTENDING YOUR REACH
WITH TOTAL INTEGRATION™

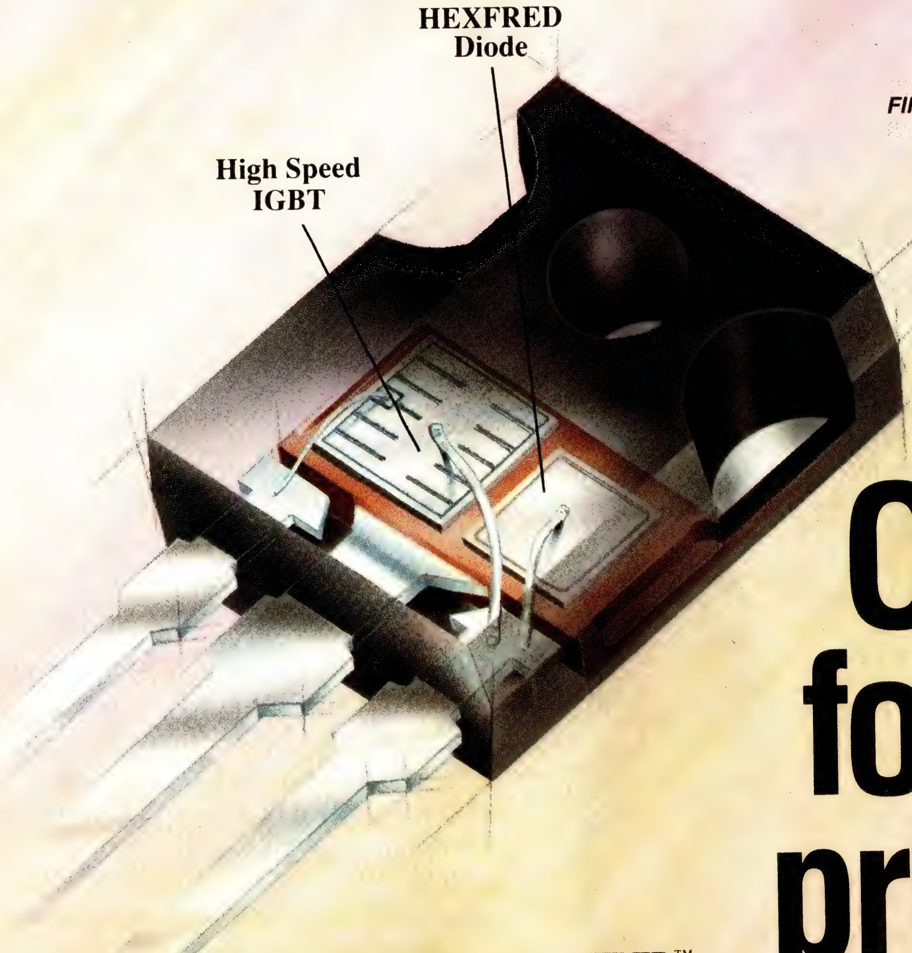
TEXAS
INSTRUMENTS

Australia & New Zealand: Sydney, 61-2-878-9000, fax 61-2-805-1186; Melbourne, 61-3-696-1211, fax 61-3-696-4446; Elizabeth, 61-8-255-2066, fax 61-8-255-2809. **Hong Kong:** 852-737-0338, fax 852-735-4954. **Korea:** 82-2-551-2800, fax 82-2-551-2828. **Malaysia:** 60-3-230-6001, fax 60-3-230-6605. **People's Republic of China:** 86-1-500-2255, ext. 3750, fax 86-1-500-2705. **Philippines:** 63-2-817-6031, fax 63-2-522-0146. **Singapore (& India, Indonesia, Thailand):** 65-350-8100, fax 65-253-6655. **Taiwan:** 886-2-713-9311, fax 886-2-716-9487.

© 1993 TI
™ Trademark of Texas Instruments Incorporated

00-7890B7ae

FIRST IN POWER SOLUTIONS

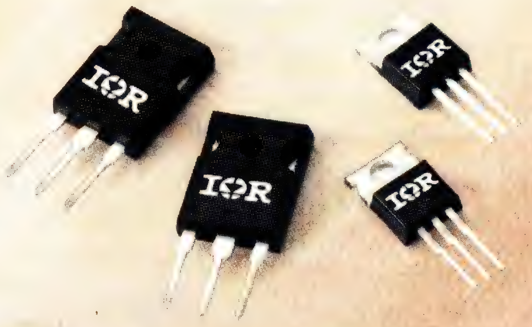


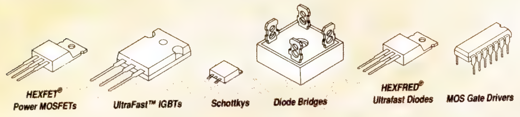
One for the price of two.

Our super-efficient IGBT and HEXFRED™ diode in a single package, the *CoPack*. Priced at or below what you'd pay for a conventional IGBT and a separate anti-parallel FRED.

CoPacks let you boost efficiency up to 30% while shrinking your circuit board. Optimize performance. Cut design time. Parts count. Inventory. And assembly.

Can you afford not to know more about IR's new *CoPack*? Write, fax, or call for price and technical data on our complete line. Delivery is off the shelf.





IOR International Rectifier

WORLD HEADQUARTERS: 233 KANSAS ST., EL SEGUNDO, CA 90245, USA (310) 322-3331. FAX (310) 322-3332. TELEX 66-4464. EUROPEAN HEADQUARTERS: HURST GREEN, OXTED, SURREY RH8 9BB, ENGLAND (0883) 713215. TELEX 95219

CIRCLE 132 FOR U.S. RESPONSE

CIRCLE 133 FOR RESPONSE OUTSIDE THE U.S.

TECHNOLOGY NEWSLETTER

CONSUMER GIANTS UNVEIL VIDEO-CD STANDARD

Four consumer-electronics heavyweights have put their heads together on a data-format standard for recording video on 12-cm compact discs. Matsushita, Philips, Sony, and Victor Company of Japan Ltd. (JVC), will push the format in such applications as movies, music, and karaoke. The Video CD standard, which includes MPEG-1 coding, is fully based on the karaoke CD format announced by JVC and Philips earlier this year. The format can store up to 74 minutes of digitized audio and motion pictures on a 12-cm CD. It has the ability to use existing video-source software and is compatible with all major broadcasting standards, including NTSC, PAL, and Secam. The four companies agreed to cooperate on creating future standards that take advantage of advances in technology, such as the impending release of the MPEG-2 algorithm from the Motion Picture Experts Group of the International Standards Organization. Specific features on the horizon include two levels of still pictures for normal and high-resolution imaging, and additional playback control with recorded control codes on the CD. The Video CD format is available for licensing. Call Satoshi Takahashi at Philips in Japan, (0427) 46-9317, or fax, (0427) 48-0889. JS

EMBEDDED-PC MODULES STANDARD READY FOR OK

The IEEE's P996.1 working group on compact embedded-PC modules is in the process of finalizing its draft standard. Finalization will formally take place at the group's next meeting, to be held on October 20 in conjunction with the Buscon East trade (Marlborough, Mass.). Earlier this year, the working group adopted the PC/104 specification as the base document for its draft standard. The specification has many changes and alterations now included in the current standard, revision D0.02. After approval of the final draft, it will be submitted to the IEEE for formal balloting and approval. P996.1 is sponsored by the IEEE Computer Society's Microprocessor and Microcomputer standards committee (MMSC). Call chairman Rick Lehrbaum, at (408) 522-3650. RN

COALITION TO AID IC-STACKING TECHNOLOGY

A memory-chip-stacking technology that, in effect, accelerates chip capacities by one or more design generations may be furthered by a coalition of industrial, government, and university participants. Building on a preexisting joint development alliance with IBM, Irvine Sensors, Costa Mesa, Calif., is leading the coalition in an effort to garner matching Federal funds under the Defense Conversion Act's Technology Reinvestment Program. One example of the technology's effectiveness involves 16 thinned 16-Mbyte DRAMs that are stacked to create the equivalent of a single 256-Mbyte DRAM with less power drain and substantially more speed. In addition, the technology allows older-generation, already-depreciated capital equipment to produce advanced memories. Other coalition members include Cal Tech's Jet Propulsion Laboratory, Compass Design Automation, Micron Semiconductor, Orbit Semiconductor, Tanner Research, the University of Southern California, the University of California at Irvine, the U.S. Air Force's Rome Laboratory, and the state of California. DM

DATA-COMPRESSION MACRO SUITS HIGH-SPEED BUSES

A lossless data-compression algorithm that runs in high-speed hardware at system bus speeds in real time is now available as a macro core. Based on a Lempel-Ziv 1 algorithm, the Adaptive Lossless Data Compression (ALDC) algorithm can now be designed into an ASIC running at 40 Mbytes/s. Because of the high speed, the circuit is applicable in such buses as VME and Micro Channel. In general, a lossless algorithm incurs no loss or corruption of data during the compression or decompression processes. Unique to ADLC is that it's adaptive, which means it adjusts to the type of data that's being compressed to increase the compression ratios. The average compression ratio for ALDC is three-to-one. The macro core is now available for OEMs. Contact the IBM Technology Products Compression Development Team at (800) IBM-0181. RN

API EASES PORTING TO MOTIF ENVIRONMENT

Porting applications from the Open Look user interface to Motif should get easier with the help of the XVM application programming interface (API). Instead of time-consuming hand translation to Motif, developers can continue to work in the XView API. The XVM interface recodes the XView library to make calls to the Motif library. XView mouse and menu behavior also are modified to reflect a Motif look and feel for creating Motif applications. XVM was developed jointly by U.K.-based Interface

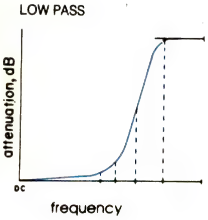
FILTERS

dc to 3GHz from $\$11^{45}$

lowpass, highpass, bandpass

- less than 1dB insertion loss
- greater than 40dB stopband rejection
- surface-mount
- BNC, Type N, SMA available
- 5-section, 30dB/octave rolloff
- VSWR less than 1.7 (typ)
- rugged hermetically-sealed pin models
- constant phase
- meets MIL-STD-202 tests
- over 100 off-the-shelf models
- immediate delivery

low pass, Plug-in, dc to 1200MHz



Model No.	Passband MHz loss < 1dB	Stopband, MHz loss > 20dB	Stopband, MHz loss > 40dB
★LP-5	DC-5	8-10	10-200
★LP-10.7	DC-11	19-24	24-200
★LP-21.4	DC-22	32-41	41-200
★LP-30	DC-32	47-61	61-200
★LP-50	DC-48	70-90	90-200
★LP-70	DC-60	90-117	117-300
★P-90	DC-81	121-137	167-400
★LP-100	DC-98	146-189	189-400
★LP-150	DC-140	210-300	300-600
★LP-200	DC-190	290-390	390-800

Model No.	Passband MHz loss < 1dB	Stopband, MHz loss > 20dB	Stopband, MHz loss > 40dB
★LP-250	DC-225	320-400	400-1200
★LP-300	DC-270	410-550	550-1200
★LP-450	DC-400	580-750	750-1800
★LP-550	DC-520	750-920	920-2000
★LP-600	DC-680	840-1120	1120-2000
★LP-750	DC-700	1000-1300	1300-2000
★LP-800	DC-720	1080-1400	1400-2000
★LP-850	DC-760	1100-1400	1400-2000
★LP-1000	DC-900	1340-1750	1750-2000
★LP-1200	DC-1000	1620-2100	2100-2500

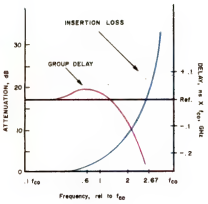
Price, (1-9 qty), all models: plug-in $14.95, BNC $32.95, SMA $34.95, Type N $35.95

Surface-mount, dc to 570MHz

Model No.	Passband MHz loss < 1dB	Stopband, MHz loss > 20dB	Stopband, MHz loss > 40dB
SCLF-21.4	DC-22	32-41	41-200
SCLF-30	DC-30	47-61	61-200
SCLF-45	DC-45	70-90	90-200
SCLF-135	DC-135	210-300	300-600
SCLF-190	DC-190	290-390	390-800
SCLF-380	DC-380	580-750	750-1800
SCLF-420	DC-420	750-920	920-2000

Price, (1-9 qty), all models: $11.45

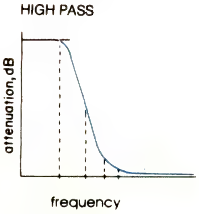
Flat Time Delay, dc to 1870MHz



Model No.	Passband MHz loss < 1.2dB	Stopband MHz loss > 10dB	Stopband MHz loss > 20dB	VSWR Freq. Range, DC thru 0.2fco X̄	VSWR Freq. Range, DC thru 0.6fco X̄	Group Delay Variations, ns Freq. Range, DC thru fco X̄	Group Delay Variations, ns Freq. Range, DC thru 2fco X̄	Group Delay Variations, ns Freq. Range, DC thru 2.67fco X̄
★BLP-39	DC-23	78-117	117	1.3:1	2.3:1	0.7	4.0	5.0
★BLP-117	DC-65	234-312	312	1.3:1	2.4:1	0.35	1.4	1.9
★BLP-156	DC-94	312-416	416	0.3:1	1.1:1	0.3	1.1	1.5
★BLP-200	DC-120	400-534	534	1.6:1	1.9:1	0.4	1.3	1.6
★BLP-300	DC-180	600-801	801	1.25:1	2.2:1	0.2	0.6	0.8
★BLP-467	DC-280	934-1246	1246	1.25:1	2.2:1	0.15	0.4	0.55
▲BLP-933	DC-560	1866-2490	2490	1.3:1	2.2:1	0.09	0.2	0.28
▲BLP-1870	DC-850	3740-6000	5000	1.45:1	2.9:1	0.05	0.1	0.15

Price, (1-9 qty), all models: plug-in $19.95, BNC $36.95, SMA $38.95, Type N $39.95
NOTE: ▲: -933 and -1870 only with connectors, at additional $2 above other connector models.

high pass, Plug-in, 27.5 to 2200MHz

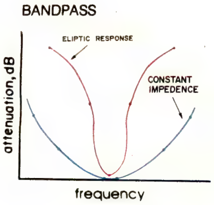


Model No.	Stopband MHz loss < 40dB	Stopband MHz loss < 20dB	Passband, MHz loss < 1dB	VSWR Pass-band Typ.
★HP-25	DC-13	13-19	27.5-200	1.8:1
★HP-50	DC-20	20-26	41-200	1.5:1
★HP-100	DC-40	40-55	90-400	1.8:1
★HP-150	DC-70	70-95	133-600	1.8:1
★HP-175	DC-70	70-105	160-800	1.5:1
★HP-200	DC-90	90-116	185-800	1.6:1
★HP-250	DC-100	100-150	225-1200	1.3:1
★HP-300	DC-145	145-170	290-1200	1.7:1

Model No.	Stopband MHz loss < 40dB	Stopband MHz loss < 20dB	Passband, MHz loss < 1dB	VSWR Pass-band Typ.
★HP-400	DC-210	210-290	395-1600	1.7:1
★HP-500	DC-280	280-365	500-1600	1.8:1
★HP-600	DC-350	350-440	600-1600	2.0:1
★HP-700	DC-400	400-520	700-1800	1.6:1
★HP-800	DC-445	445-570	780-2000	2.1:1
★HP-900	DC-520	520-660	910-2100	1.8:1
★HP-1000	DC-550	550-720	1000-2200	1.9:1

Price, (1-9 qty), all models: plug-in $14.95, BNC $36.95, SMA $38.95, Type N $39.95

bandpass, Elliptic Response, 10.7 to 70MHz



Model No.	Center Freq. (MHz)	Passband I.L. 1.5 dB Max. (MHz)	3 dB Bandwidth Typ. (MHz)	Stopbands I.L. > 20dB at MHz	Stopbands I.L. > 35dB at MHz
★BP-10.7	10.7	9.6-11.5	8.9-12.7	7.5 & 15	0.6 & 50-1000
★BP-21.4	21.4	19.2-23.6	17.9-25.3	15.5 & 29	3.0 & 80-1000
★BP-30	30.0	27.0-33.0	25-35	22 & 40	3.2 & 99-1000
★BP-60	60.0	55.0-67.0	49.5-70.5	44 & 79	4.6 & 190-1000
★BP-70	70.0	63.0-77.0	68.0-82.0	51 & 94	6.0 & 193-1000

Price, (1-9 qty), all models: plug-in $18.95,
BNC $40.95, SMA $42.95, Type N $43.95

Constant Impedance, 21.4 to 70MHz

Model No.	Center Freq. MHz	Passband MHz loss < 1dB	Stopband loss > 20dB at MHz	VSWR 1.3:1 Total Band MHz
★IF-21.4	21.4	18-25	1.3 & 150	DC-220
★IF-30	30	25-35	1.9 & 210	DC-330
★IF-40	42	35-49	2.6 & 300	DC-400
★IF-50	50	41-58	3.1 & 350	DC-440
★IF-60	60	50-70	3.8 & 400	DC-500
★IF-70	70	58-82	4.4 & 490	DC-550

Price, (1-9 qty), all models: plug-in $14.95,
BNC $36.95, SMA $38.95, Type N $39.95

NOTE: **★Add Prefix P, B, N, or S for Pin, BNC, N, or SMA connector requirement.**

CIRCLE 156 FOR U.S. RESPONSE

CIRCLE 157 FOR RESPONSE OUTSIDE THE U.S.

finding new ways ...
setting higher standards

Mini-Circuits™

WE ACCEPT AMERICAN EXPRESS AND VISA

P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661

Distribution Centers/NORTH AMERICA 800-654-7949 • 417-335-5935 Fax 417-335-5945 EUROPE 44-252-835094 Fax 44-252-837010

Engineering Software Ltd. and the Qualix Group Inc., San Mateo, Calif. Qualix is accepting beta site applications to test-run the product. Contact Shirley Kumamoto, programming tools product line manager, at (415) 572-0200, or through e-mail: shirley@qualix.com. SVT

COLOR-PRINTER CONSORTIUM FORMED

A newly formed industry consortium, the Association of Thermal Transfer Technology (ACT), will help supply more advanced color-printer-based products while promoting the technology's application-specific advantages. The color thermal-transfer printers are based on ink-jet technology, which is responsible for the high-quality output. They're suited for such applications as CAD, imaging, graphic arts, and electronic publishing. The ACT consortium consists of color thermal-transfer printer manufacturers and suppliers, including Armor Nantes, Calcomp, Diafoil, Fujicopian, International Imaging Materials, Mitsui Plastics, and Tektronix. Headquartered in Buffalo, N.Y., the group will serve as an umbrella for the effort and will work with members on technology-advancement seminars and other pursuits. For more information, call (716) 691-6333, ext. 426. RN

FIBRE CHANNEL GETS OFFICIAL ORGANIZATION

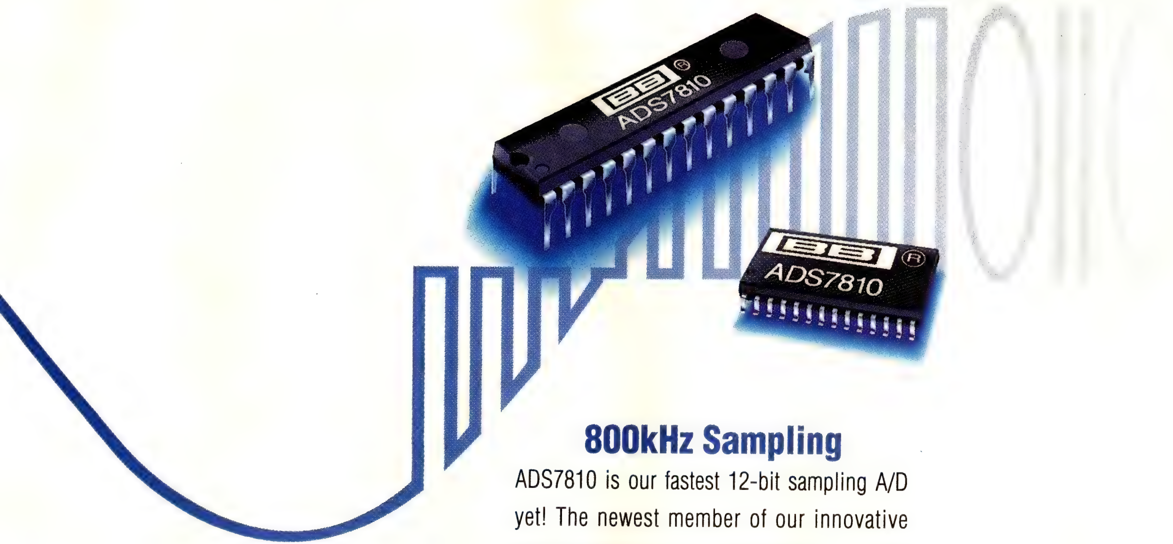
The Fibre Channel Association, more than 20 organizations strong, announced its formation last month at the Interop Conference in San Francisco, Calif. Its objective is to advance the technology to create the gigabit highways needed for future computer generations. The group, located in Austin, Texas, will also serve as a central resource of information for all aspects of Fibre Channel, which is a serial switching network that can transfer data bidirectionally at rates of 12.5, 25, 50, or 100 Mbytes/s. Furthermore, there are plans to increase awareness of Fibre Channel's benefits when applied to high-speed processors and distributed client-server architectures. Some of the principal members include Applied Micro Circuits, AT&T Microelectronics, Cypress Semiconductor, Emulex, Fujikura Technology America, Hewlett-Packard, IBM, Interphase, Siemens, StorageTek, Sun Microsystems, Tandem Computers, and TriQuint Semiconductor. Associate and educational members include GEC Plessey and the Lawrence Livermore National Laboratory. The Lawrence Livermore Labs will also serve as the main interoperability test center. Contact the association at (800) 272-4618 or send e-mail to fibre-channel-ext-request@think-.com. Or call Steven Wampler at the Lawrence Livermore Labs, (510) 423-3107. DB

NEXT-GENERATION GAMES TO USE 64-BIT MUSCLE

A 3D-capable game for under $250 is the ultimate goal of designers at Nintendo Co. Ltd., Tokyo, Japan, and Silicon Graphics Inc., Mountain View, Calif., who will collaborate to develop a 64-bit chip set for the game console. The joint agreement couples the game expertise of Nintendo and the visual computing technologies of Silicon Graphics (used in such movies as Jurassic Park and Terminator 2). Together, they will produce Reality Immersion Technology (RIT) to allow players to step inside real-time 3D worlds. At the heart of the system will be the MIPS Multimedia Engine chip set—a 64-bit MIPS RISC microprocessor, a graphics coprocessor, and one or more custom chips. The chip set's computing power will exceed the throughput of most workstations. For instance, at a 100-MHz clock, the CPU executes over 100 MIPS and 100 MFLOPS. The graphics subsystem also matches most moderate-performance workstations. It handles 24-bit color images and generates more than 100,000 polygons (50-pixel meshed triangles) per second while performing real-time antialiased 3D texture mapping to produce realistic graphic images. The set will also handle CD-quality audio and provide video resolution better than the NTSC or PAL standards. RIT and the chip set will let software developers take advantage of the Silicon Graphics' graphics library. The technology's first implementation will debut in 1994 as an arcade-style game, and is expected in a home game console by late 1995. DB

MIXED-SIGNAL CIRCUIT SIMPLIFIES PEN INPUT

By combining all critical analog functions necessary to capture pen-position data, a mixed-signal circuit can transform sensor-grid information into the digital data needed by a pen system controller. The chip not only blends together the pen-signal amplification, noise filtering, and signal detection, but also analog-to-digital-conversion circuitry and built-in power-management logic to conserve overall system power. By integrating all of the functions, designers at Kurta Corp., Phoenix, Ariz., eliminated many potential error sources: Simply, the better the data capture, the better the quality of the character recognition. The circuit was designed to operate over a 2.7-to-5.5-V supply range, allowing it to fit into almost any portable or desktop pen-based system. Its outputs are used by a pen controller to determine pen location and the status of its typical switches. Contact Gary Fitzgerald at (602) 276-5533. DB



FAST!

800kHz Sampling

ADS7810 is our fastest 12-bit sampling A/D yet! The newest member of our innovative ***ADS Family,*** it's a full-function device, complete with clock, sample/hold, internal reference, and parallel microprocessor interface. Its CMOS structures and innovative design keep power dissipation below 250mW and allow operation from ±5V supplies.

World's Fastest

ADS7810's 800kHz sampling rate is guaranteed over the extended industrial temperature range of–40°C/+85°C making it the world's fastest 12-bit, monolithic SAR ever—60% faster than its closest rival! And, it's the easiest A/D to use in this performance range. DC and AC accuracy are excellent, and "no missing codes" over temp at 12-bits is guaranteed. Other key specs include: 12 bit resolution, 69dB (min) SINAD, ±0.5LSB (max) INL, ±1LSB (max) DNL, standard ±10V input range, and 250mW (max) power dissipation. Available in 28-pin plastic DIPs, SOICs, and in die form, it's the fastest member of the family. Performance plus low pricing make the ***ADS Family—***
Bit for bit, the best A/Ds ever!

BURR - BROWN®

Burr-Brown Corporation • Corporate Headquarters • P.O. Box 11400 • Tucson, AZ 85734 USA

International Subsidiary Offices: Austria (43) 222 62 63 71, **France** (33) 1 395 43558, **Germany** (49) 711 77040, **Italy** (39) 2 580 10504, **Japan** (81) 33 586 8141, **Netherlands** (31) 20 6010041, **Switzerland** (41) 1 7240928, **United Kingdom** (44) 923 233837.

CIRCLE 297 FOR U.S. RESPONSE CIRCLE 298 FOR RESPONSE OUTSIDE THE U.S.

SHARP

PROGRESS REPORT

Dedicated to the proposition that one good idea leads to another.

At the turn of this century, the most common handheld computing device was a simple pencil put to paper. In 1912, Sharp went this one better by developing and manufacturing the world's first *mechanical* pencil — the EverSharp — and, ever since, we've been helping engineers and designers rewrite the future in a big, big way.

Two new families of sub-VGA liquid crystal monochrome displays from Sharp achieve the best performance yet seen in small LCDs. They rival CRTs for brightness and contrast and save valuable space. The LM32P10, for example, features a 320 x 240 display format and .30 mm dot pitch in about a 3″ x 4″ package, plus an 18:1 contrast ratio and 70 nits of brightness. Our .36 mm dot pitch displays provide similar performance in approximately 4″ x 5″ packages. Sharp's goal is to produce LCDs with viewing comparable to black ink on white paper, and these displays are nearly there.

Looking ahead, we see personal digital devices providing computations, voice/vision and fax communications, plus specialized mechanical and measurement functions, all containable in handy pad-sized dimensions.

Here's how a few of today's components from Sharp Electronics Corporation are helping designers conceptualize and create tomorrow's generation of handheld tools.

SHARP SUB-VGA GRAPHICS DISPLAYS: THE SKY'S THE LIMIT!

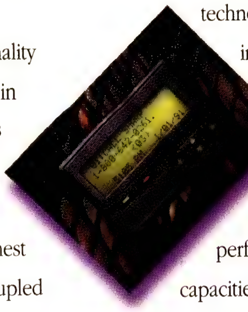
The world leader in active and passive matrix liquid crystal and electroluminescent displays, Sharp now brings a new standard of price/performance to its line of sub-VGA graphics and character displays, providing unprecedented response, resolution and reliability, all at a cost equivalent to some lower performance displays.

By boosting the functionality of these devices, now found in everything from video games to office equipment, Sharp expands the boundaries of portable computing: the highest LCD performance is now coupled with lower-than-ever pricing and Sharp's unmatched level of U.S.-based inventory, service and support, assuring that fewer technicalities stand in the way of your progress.

From the mechanical pencil t

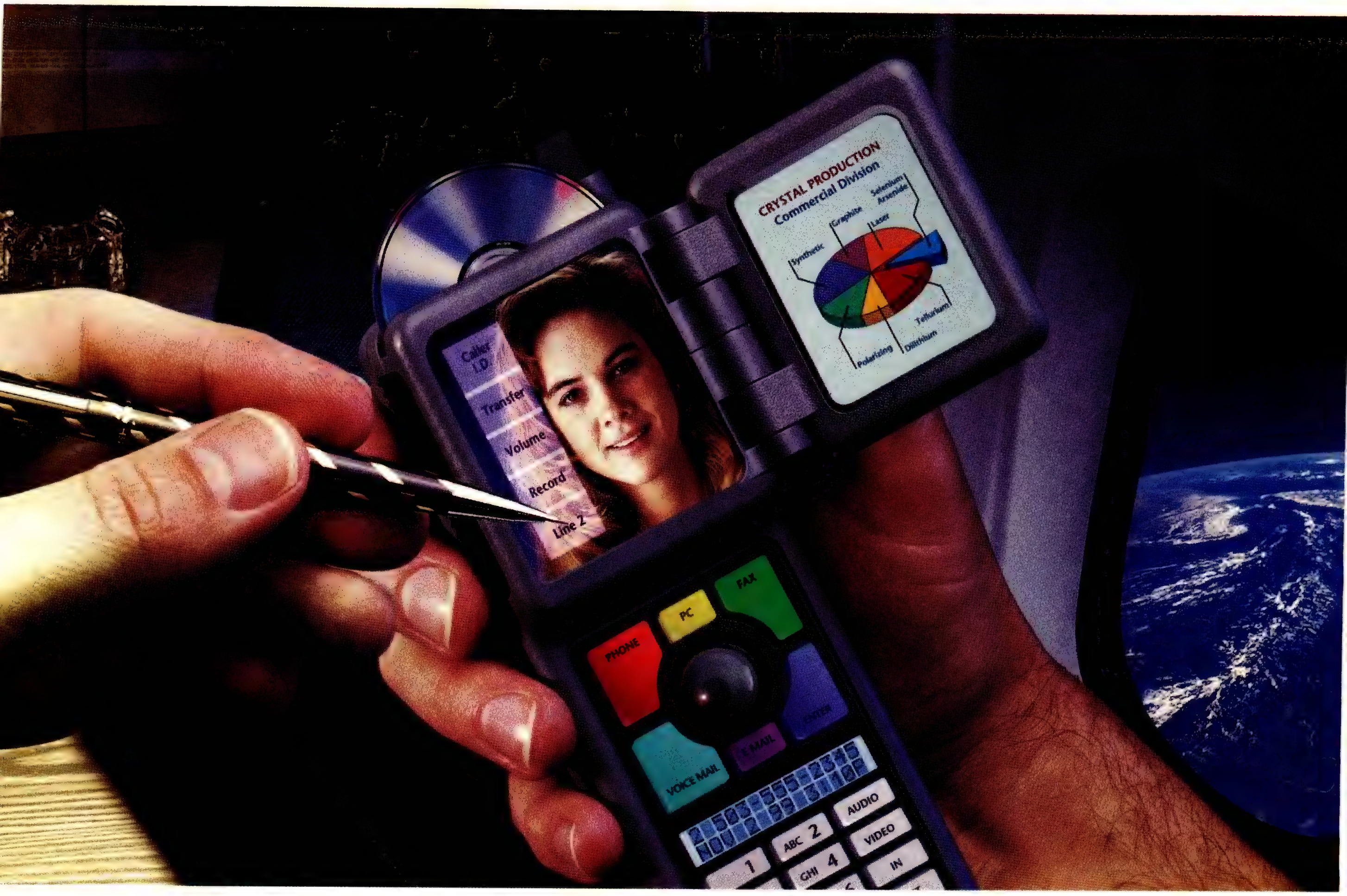
SHARP MEMORY DEVICES DELIVER GREATER PORTABILITY WITH LESS POWER.

As you'd expect from the #1 Mask ROM supplier, Sharp's 3-volt MROMs feature a space- and power-saving technology which also improves system performance with capacities from 1 to 16 Mb in a wide range of innovative packaging options.

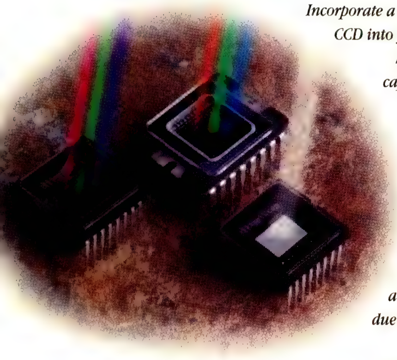


Pagers are becoming smaller and more feature-packed than ever, thanks to low-power components like Sharp's 3-volt MROMs. Densities range from 1 to 16 Mb, and Sharp's proprietary NOR flat-cell structure allows for smaller packaging and faster speeds than conventional NAND-gate designs.

Sharp is also the designer's supplier of choice for Static RAMs, including 3-volt and Ultra Low Power SRAMs that draw as little as 1/30th the power of competitive products, while offering ratings able to withstand the toughest down-to-earth portable applications — operating temperatures ranging from -40° C to +85° C, for example. And when a mixed voltage system is required, Sharp's 3-volt circuitry allows for easy interfacing with existing 5-volt components, with a smooth transition to pure 3-volt solutions.



he cosmic communicator: it's not pie-in-the-sky anymore.



Incorporate a high-sensitivity CCD into your design for high-end image capture in monochrome or color with up to 600 mV sensitivity; a volume-minded CCD with 362 x 494 pixels; or a new 1/4″ CCD due later this year.

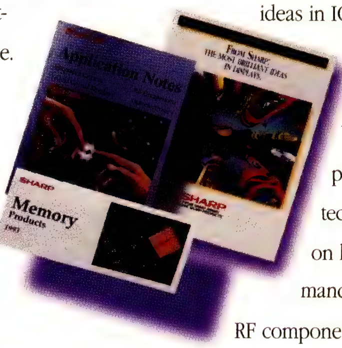
SHARP CCDs ARE WINNING TODAY'S SPACE RACE.

Sharp now strengthens its leadership in imaging products with Charge Coupled Devices which provide new opportunities in everything from multimedia systems and video phones to machine vision and 2-D bar-coding. Whether you need lower-resolution for design simplification at an amazingly affordable price, or high-sensitivity devices for unsurpassed image capture, Sharp can match your application with the most cost-effective product possible.

And soon, Sharp will transition to an industry-leading 0.5 micron process with a 1/4″ device in late '93 — the industry's next giant leap forward in compact, lightweight CCD performance.

FREE FROM SHARP: A GUIDED TOUR INTO THE FUTURE OF PERSONAL COMPUTING.

For an in-depth look at Sharp's extensive product lines, send for our free information-packed Memory Products guide and full-line LCD brochure. Or ask for our Application Notes handbook covering innovative ideas in IC, RF, Opto and LCD applications. We can also provide detailed technical literature on high-performance DSP chips, RF components and optoelectronics. Simply contact your nearest Sharp Electronics Corporation sales office or call us toll-free at **1-800-642-0261, Ext. 901.**



SHARP®

FROM SHARP MINDS COME SHARP PRODUCTS™

FOR MORE INFORMATION CALL SHARP AT 1-800-642-0261 EXT. 901

Copyright © 1993 Sharp Microelectronics Group.

SEC-0793

CIRCLE 204 FOR U.S. RESPONSE

CIRCLE 205 FOR RESPONSE OUTSIDE THE U.S.

What's square and difficult to burn?

The Tandon Notebook personal computer with its Bayblend FR 90 housing

Bayblend® FR 90: now free of environmentally harmful additives

It's anybody's guess what poorly combustible, four-cornered object this little rascal might be thinking of. But if it's a flame-retardant housing for business machines, our answer would be Bayblend FR 90. Because this high-tech, low-flammability thermoplastic from Bayer is the material for flame-retardant business machine housings.

Bayblend FR 90 owes its success to a combination of attractive properties:

- antimony and bromine-free flame retardants (i.e. no environmentally harmful additives)
- excellent weld strength
- high mechanical strength
- high heat resistance.

And now there's also a new product in the range: Bayblend FR 110, for applications where an exceptionally high level of heat resistance is required. And most important, both Bayblend FR 90 and FR 110 are easy to recycle – not just once, but several times.

Plastics Business Group

Bayer

Detailed technical information on Bayblend FR containing the flame retardant system free of antimony and bromine may be obtained from:
Bayer AG/DT FR
Postfach 800149
D-51001 Köln

KU 5282 e.i.

CIRCLE 94 FOR U.S. RESPONSE
CIRCLE 95 FOR RESPONSE OUTSIDE THE U.S.

LEAKY FIBER WITH OPTICAL TAPS DEVELOPED FOR VERY WIDEBAND CELLULAR WIDE-AREA NETWORK

By applying computer-generated holographs and arrays of silicon microlenses to an optical fiber with a novel D cross section, engineers at the Martlesham Heath, England, research laboratories of British Telecom plc (BT) came up with a new concept for a cellular wireless wide-area network. Because it uses lightwaves rather than radio, it will have almost unlimited bandwidth. Even better, it will not require permissions, approvals, and licenses from telecommunications or radio-frequency regulators.

The network idea relies on the insertion of "optical taps" in an optical fiber that can be installed around a building at ceiling height. At each tap position, some power from the lightwave is refracted through 90° so it radiates from the fiber. Each tap can then feed a transmitter that communicates with handheld or other terminals. It's analogous with so-called leaky feeder antennas that propagate radio signals in confined spaces, such as tunnels. Needless to say, that's why BT's scientists dubbed it a "leaky fiber."

Project leader Peter Smyth sees the technology as an enabler for efficient use of pen and laptop computers. He says infrared communications systems could be based on consumer optoelectronic components, such as 850-nm sources and silicon detectors, at projected cost that's much lower than conventional microwave radio-based wireless network systems.

The leaky feeder uses optical fiber that's specially shaped during manufacture to have a D-shaped cross section. The D-fiber is produced by removing part of the circular cladding at the fiber preform stage, which causes the lightwave-carrying fiber core to be just a few micrometers below the flat surface. There's no loss of optical power so long as any material in contact with the D-fiber's flat surface has a lower index of refraction than that of the fiber core.

But if a material with a higher index of refraction meets the flat surface, light will couple from the core into the overlaid material at a rate determined by the distance from the core to the flat surface of the D-fiber. The refractive index of the overlay material determines the angle at which the light emerges.

By using a microlens or other scattering surfaces on the D-fiber's flat surface, the emerging optical power can be shaped to cover wide or narrow angles with different inclinations to the fiber surface *(Fig. 1)*. In principle, the lensing or scattering features could be incorporated into the fiber or overlay materials.

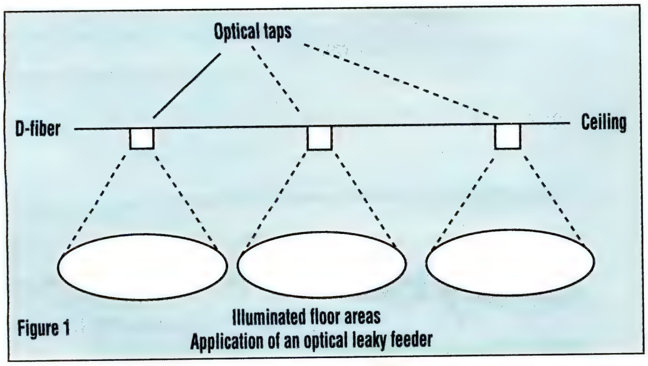


Figure 1
Application of an optical leaky feeder

In a series of trials, Smyth's group set out to make a leaky fiber that gave quasi-continuous coverage. They used lengths of D-fiber that were fusion-spliced to the tail of a semiconductor communication laser featuring a 1500-nm wavelength. A silicon microlens array measuring 1 cm^2 and containing 6400 lenses on a 250-μm grid was placed in optical contact on part of the D-fiber flat *(Fig. 2)*.

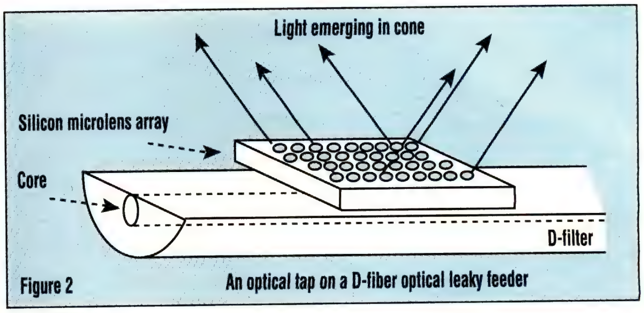


Figure 2 An optical tap on a D-fiber optical leaky feeder

The light emitted by the panel of microlenses is symmetrically distributed, normal to the panel, and spatially incoherent. In other words, power distribution can be relatively high without infringing on safety regulations that restrict radiation of direct-laser or 1550-nm LED light into free space to a maximum of 0.6 mW.

The power-emission lobe has a 38°, 3-dB half-angle, with 80% of the input power from the laser diode being detected in the output lobe. Smyth calculates that this would illuminate a 4-m-diameter area at desk level from a ceiling 2.5-m high.

In addition to distributing signals around an area to form a series of fixed cell-like transmitter stations, the leaky fiber can also be used to make an omnidirectional antenna for cordless terminals. Smyth envisions encasing a short spiral of the D-fiber in a transparent tube. Its optical taps would be arranged to radiate in all directions around the tube's periphery.

This application does raise issues of safety, though. Radiation at the shorter wavelengths is limited by international standards to reduce the danger of damage to the human eye and skin. National and international standards on laser safety, such as the IEC825, specify what optical emission levels are safe. Here, products are classified according to the hazard, with Class 1 being defined as inherently safe even when viewed with optical instruments like binoculars. "It will be necessary for optical wireless applications to fall into this category," says Smyth.

He also says that the wavelengths of relevance for optical wireless local-area-network (LAN) systems will be 850, 1300, 1480, and 1550 nm, because suitable emitters and detec-

Are your memory solutions a little less than ideal?

EDRAM won't take a trunk full of cache.

Yesterday's memory solutions can gobble up a lot of cache to compensate for the speed differences between memories and processors.

Now, there's a better alternative to SRAM cache. It's our innovative new 4Mb, 15ns EDRAM (Enhanced DRAM) family. It combines a proven ultra-high-performance DRAM array with a tightly integrated on-chip SRAM cache that provides 15ns page reads and writes. There's no page-miss penalty either, because you even get better random read/write performance. The result? Big savings over traditional DRAM plus cache with less space, less power and no external cache controller.

Part #	Organiz.	Page Cycles	Random R/W Access	Package
DM2200	4Mb x 1	15ns	35ns/15ns	300 mil SOJ
DM2202	1Mb x 4	15ns	35ns/15ns	300 mil SOJ
DM2212	1Mb x 4	15ns	35ns/15ns	300 mil SOJ
DM1M32	1Mb x 32	15ns	35ns/15ns	72 pin SIMM
DM1M36	1Mb x 36	15ns	35ns/15ns	72 pin SIMM

With the combination of DRAM cost, DRAM density and SRAM performance, EDRAM is the first practical solution that offers better performance than traditional DRAM plus cache solutions in high-performance computers. Its compatibility with today's DRAMs even allows designs with a simple upgrade path.

Don't let yesterday's approaches devour your cash. Get all the details, including benchmark results, by calling 1-800-545-DRAM today. Ask about our CLEAR advantages.

THE C.L.E.A.R. ADVANTAGE

1850 Ramtron Drive, Colorado Springs, CO 80921. (719) 481-7000. ©1993 Ramtron International Corporation RAM204

CIRCLE 336 FOR U.S. RESPONSE CIRCLE 337 FOR RESPONSE OUTSIDE THE U.S.

tors are available. Maximum safe-power levels near the visible spectrum will be relatively low, because the eye is particularly efficient at focusing and absorbing the radiation. At wavelengths greater than 1400 nm, the retina isn't at risk, but skin damage is possible. He expects that revising the IEC825 standard may relax the requirements a little and will set maximum power for Class 1 at 850 nm of 0.4 mW, at 1300 nm of 8 mW, and at 1480 and 1550 nm of 10 mW.

But, Smyth points out, semiconductor lasers are capable of producing much greater powers than the safety limits—between 10 and 100 mW. To be safe, it's necessary to change the laser from a point source to a large area source that can't be focused back to a single point.

Smyth's team achieved the effect using computer-generated holograms that convert a single-point light source to many equal-intensity beams overlapping in the far field *(Fig. 3)*. Changing the hologram pattern allowed the light's distribution to be tailored for specific requirements.

Once the patterns are generated, they can be reproduced inexpensively. "The hologram pattern is printed as a phase-only relief pattern, etched into the surface of a transparent glass substrate using e-beam lithography and reactive-ion etching to print a master copy of the phase pattern that's sufficiently accurate," explains Smyth.

Copies of the etched surface pattern can be made inexpensively by embossing methods similar to those used to make credit-card holograms. Smyth claims the patterns can be printed onto ordinary domestic "cling film" where they could be wrapped around an optical antenna on a mobile terminal.

The hologram's phase pattern determines the angular distribution of light emitted from its surface. A single small cell is stepped out in a lattice to cover the top surface area of the emitter package. Black areas denote etched regions that produce a half-wavelength phase shift in the light; white areas denote unetched regions. The resultant image is a large array of spots, each with a greatly reduced intensity covering an area determined by the hologram's angular distribution. The hologram is determined by the feature size of the hologram phase pattern.

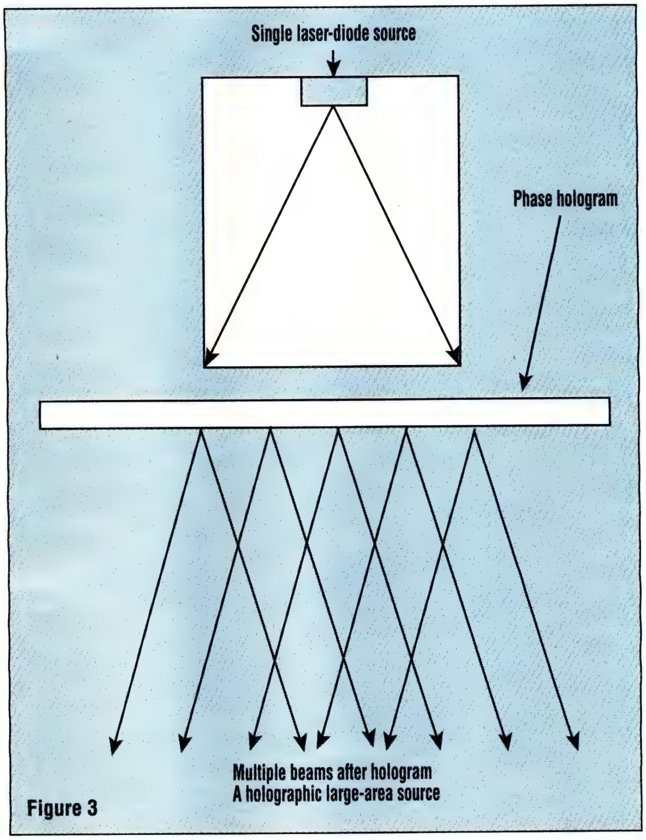

Single laser-diode source
Phase hologram
Multiple beams after hologram
A holographic large-area source

Figure 3

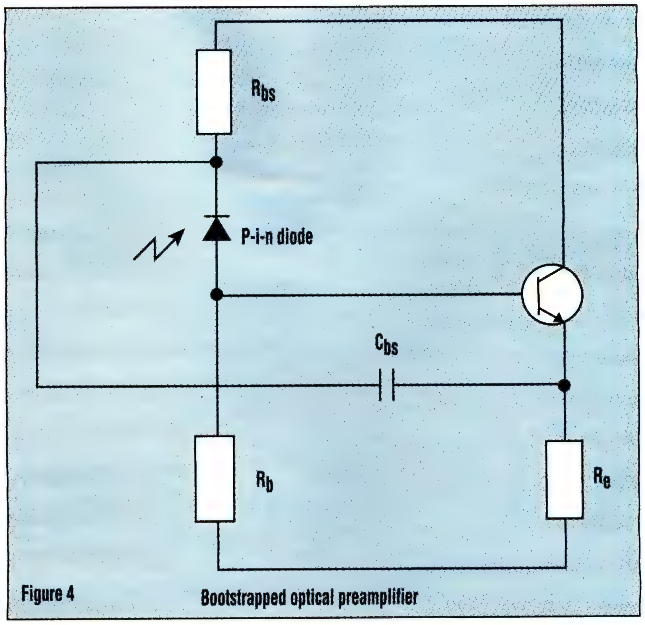


Figure 4 Bootstrapped optical preamplifier

A 10-cm^2 hologram that distributes light uniformly into a semi-angle of 23° would allow the use of a laser or LED that emits over 12 W, which is within the current limits defined by safety regulations. Even considering that safety regulations will likely reduce permitted radiation levels by 100 times, the total emissions through the hologram and D-fiber devices are several orders of magnitude greater than would be allowed from single-point sources, adds Smyth.

Smyth estimates that for a typical office, with a 10-m-by-10-m floor area, such transmitter power levels could provide bit rates of 10 to 100 Mbits/s, given a uniform distribution of the floor and a receiver collection area of 1 cm^2. Receiver sensitivity at these bit rates, determined by ambient-light shot noise, would need to be about 0.1 and 1 μW, respectively.

A receiver for a high-speed optical wireless LAN must possess a wide bandwidth to allow for high system data rates (perhaps 100 Mbits/s), good sensitivity to maximize system power margin, and a large dynamic range to allow for the changing receive-power levels in a wireless environment. A system that reduces the field of view of the receiver's photodetector can use an optical interference filter to lower the noise created by the ambient light level to below that generated by the preampli-

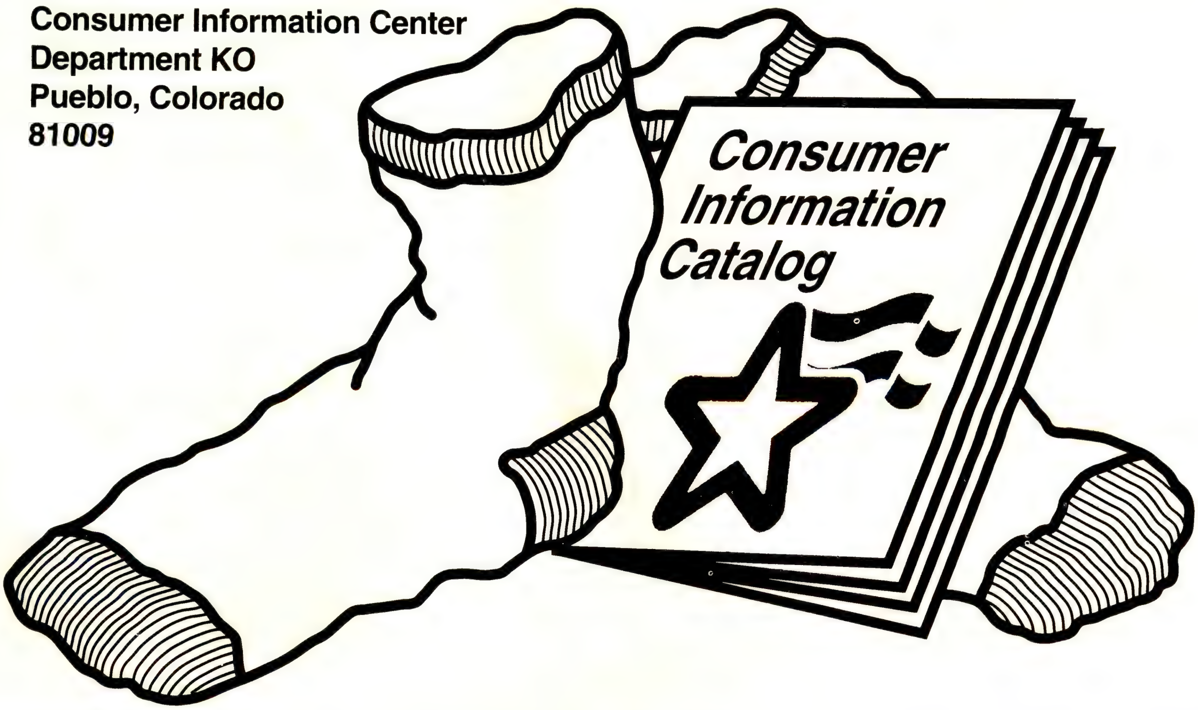
"YOUR FREE CATALOG KNOCKED MY SOCKS OFF"

We get that sort of comment all the time. People are impressed that our free Consumer Information Catalog lists so many free and low-cost government booklets. There are more than 200 in all, containing a wealth of valuable information.

They tell you how to make money, how to save money and how to invest it wisely. They tell you about federal benefits, housing and educating your children. They fill you in on nutrition, jobs, health, cars, travel, and much more.

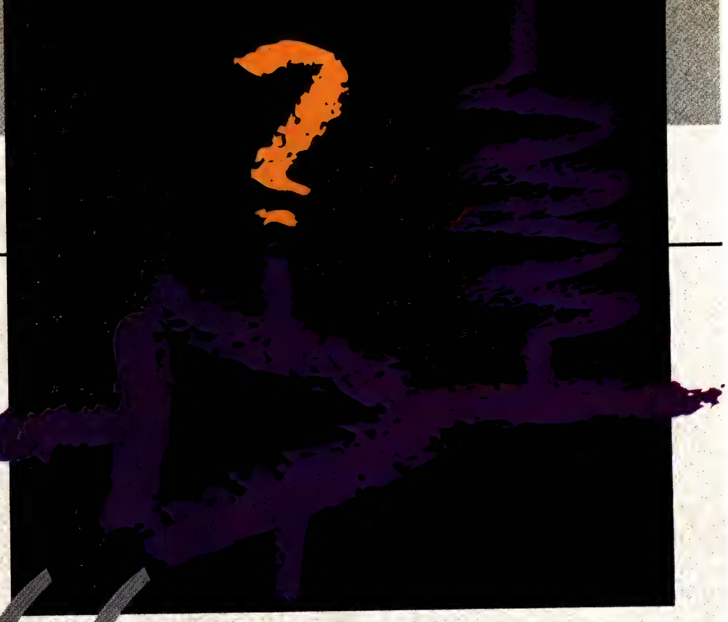
Our free Catalog will very likely impress you, too. But first you have to get it. Just send your name and address to:

Consumer Information Center
Department KO
Pueblo, Colorado
81009



A public service of this publication and the Consumer Information Center of the U. S. General Services Administration

CONVERSATIONS WITH

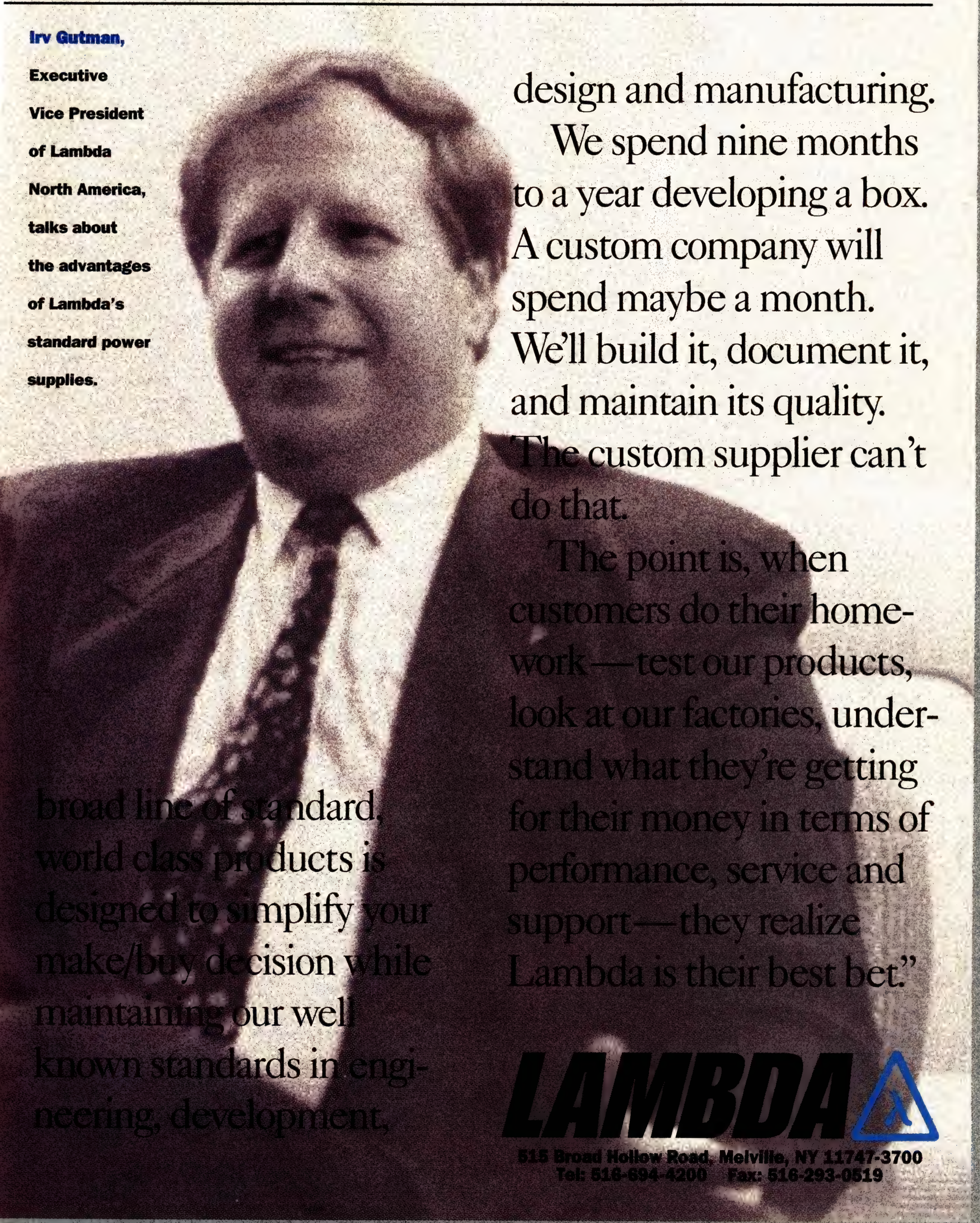


"Why does anybody buy a custom power supply, really? Because they haven't bothered to see what's already out there.

If a designer takes the time to look around early in the design process, he'll probably find a product from Lambda that fits the bill perfectly. But if he waits too long, he has to buy a custom supply. He has no choice.

Lambda gives you plenty of choices. Our

> "There's two kinds of guys out there—guys who forget about the power source until the end and *have* to build it, and guys who know better."

HE WORLD'S LEADING POWER SUPPLY COMPANY

Irv Gutman, Executive Vice President of Lambda North America, talks about the advantages of Lambda's standard power supplies.

broad line of standard, world class products is designed to simplify your make/buy decision while maintaining our well known standards in engineering, development, design and manufacturing.

We spend nine months to a year developing a box. A custom company will spend maybe a month. We'll build it, document it, and maintain its quality. The custom supplier can't do that.

The point is, when customers do their homework—test our products, look at our factories, understand what they're getting for their money in terms of performance, service and support—they realize Lambda is their best bet."

LAMBDA λ

515 Broad Hollow Road, Melville, NY 11747-3700
Tel: 516-694-4200 Fax: 516-293-0519

LAMBDA-COUTANT LAMBDA NOVATRONICS INC. WEIR ELECTRONICS

CIRCLE 312 FOR U.S. RESPONSE CIRCLE 313 FOR RESPONSE OUTSIDE THE U.S.

fier electronics. For a larger field of view, colored-glass-based optical filters help minimize ambient-light-generated noise, but this noise can still dominate the receiver's sensitivity.

Although both imaging and non-imaging collection optics can help increase the the photodetector's effective area, the wireless receiver still has a much larger photodetector than that of a fiber-optic-based one. This is required to maximize the amount of light collected by the photodiode and hence maximize the system's power budget. For a system with a receiver half-angle field of view of 20°, a typical photodetector diameter would be 7 mm versus 50 mm for a fiber-optic-based receiver.

However, this larger photodiode area means that the photodiode capacitance at the input to an optical wireless receiver is much larger than that of the fiber-optic receiver—typically 100 pF. This means using a "bootstrap" positive-feedback circuit, such as a common-collector preamplifier *(Fig. 4)*.

Trial installations of the technology are being used in London to carry 140-Mbit/s digital video signals around a university campus. The leaky feeder here is around 4.5-km long. At BT's laboratories, the technology has been used to connect cordless ISDN terminals and Videotelephones to a digital PBX. Smyth says an optical wireless LAN could be ready for market by 1998.

Contact BT Development and Procurement, BT Laboratories, Martlesham Heath, Ipswich, IP5 7RE, England; phone: +44 (0) 473 642970.

PETER FLETCHER

CURRENT-INPUT ARCHITECTURE LEADS TO IMPROVED IC ADC

Though most analog-to-digital converters digitize voltages, a number of signal sources, particularly light-sensitive diodes, provide small currents as their analog output signal. These diodes form the heart of many sensor-based systems.

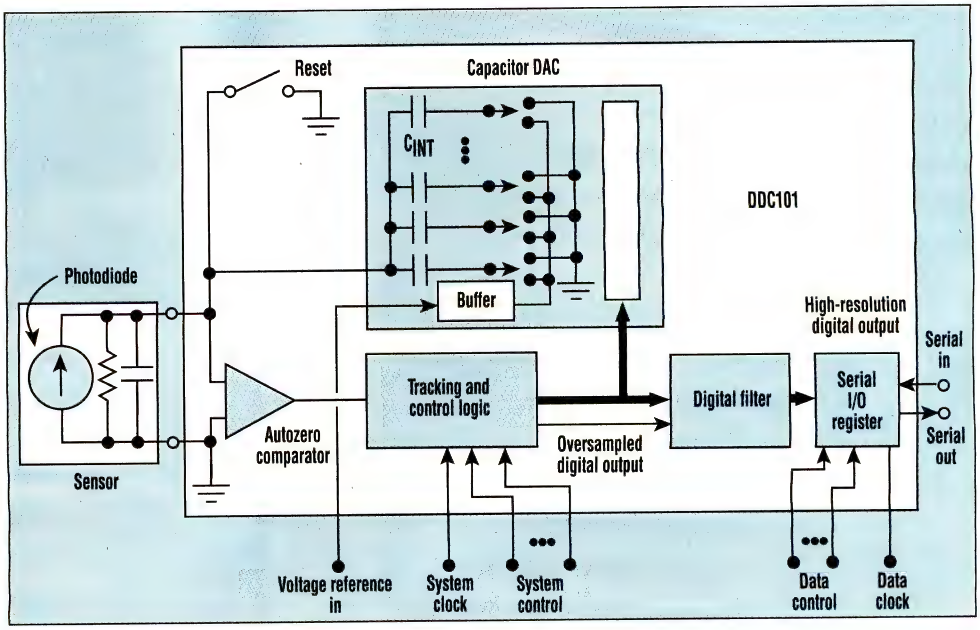
The simplest way to digitize a signal current is by converting it to a voltage with a low-bias-current op amp, and then feeding the op amp's output to a voltage-input ADC. But many high-resolution applications (16 or more bits) apply the current from the diodes to a switched-capacitor integrator IC that accumulates the current as charge for a controlled period of time. The integrator's voltage output thus feeds the ADC.

Now IC designers at Burr-Brown have combined the switched-capacitor integrator with a digital-to-analog converter, a comparator, a digital filter, and a programmable-gain-amplifier-type circuit all on one chip—the DDC101. The result is a new ADC architecture specifically designed to handle current inputs *(see the figure)*. Unlike voltage-input ADCs, the novel circuit offers lower noise and linearity errors as the input signal decreases. Consequently, the relative accuracy at low and mid scale nears that for a full-scale input. Functionally, the ADC looks like a high-quality, low-bias-current, switched integrator followed by a precision floating-point amplifier that automatically selects matched gains from 1 to 32.

During conversion, the chip's internal integration capacitance C_{INT} collects the input current for a user-selected integration time. A precision autozeroed comparator samples the analog input and the tracking logic updates the internal high-resolution, switched-capacitor DAC at 2 MHz. During the integration time, the circuit "tracks" the integration of the signal. By alternately switching between ground and the external −2.5-V reference V_{REF}, the DAC's binary-weighted capacitor array accumulates the input signal's charge, keeping the input to the comparator at a virtual ground.

A digital filter oversamples the tracking logic's output signal at the start and end of each integration period. The user sets the ratio (M) of the oversampling frequency to the signal frequency at any one of the following values: 1, 2, 4, 8, 16, 32, 64, 128, or 256. Broadband noise during the conversion is reduced in proportion to the square root of M. Thus a conversion with an M of 256 has half the noise of one with an M of 64.

The circuit subtracts the oversampled value at the start of integration from the value at the end of integration, eliminating errors through this correlated double sampling. The digital filter passes the low-noise high-resolution digital output to the serial I/O register. The converter's input full-scale range (FSR), a voltage for most ADCs, is a capacitance of



Introducing Motorola's New Single-Board Computer.

Meet the remarkable MVME197. It measures a mere 6x9 inches, but has the strength of several boards. In fact, the MVME197 is packed with more functionality, and more performance, than any single-slot 6U VME board ever designed.

On the other hand, we did have twice the room to work with. Because we put surface mount components on both sides of the board, front and back.

Fast and Compact.

The MVME197 is driven by single or dual 50 MHz RISC processors. These powerful MC88110 engines take advantage of both on-board cache and Symmetric Superscalar™ processing. Making no single-slot 6U VME board on the market a match for the lightning-fast MVME197.

But while it's a speed demon, it's also a space miser.

In addition to using both sides of the MVME197 board, we squeezed more functions into fewer ASICs. We also increased board density with LGA surface mounts. And we improved performance reliability with a new, highly-advanced soldering technique.

FIVE - YEAR
MOTOROLA
COMPUTER GROUP
5
WARRANTY

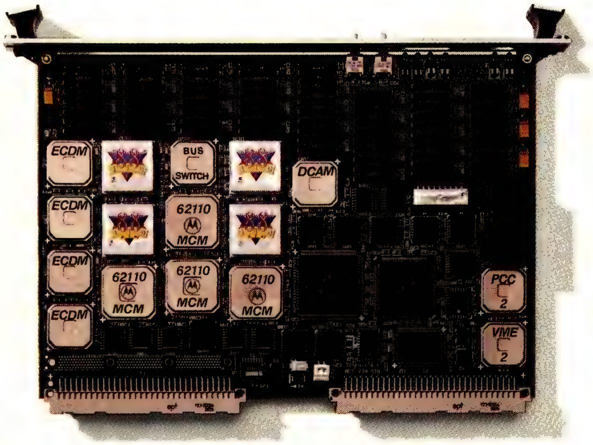
Six Boards In One.

Now, when space is crucial, the MVME197 will do the job of six ordinary boards. So you can add more functions. Consume less power. And pay a whole lot less than you would for half a dozen peripheral boards. But what else would you expect from the leading supplier of VME boards?

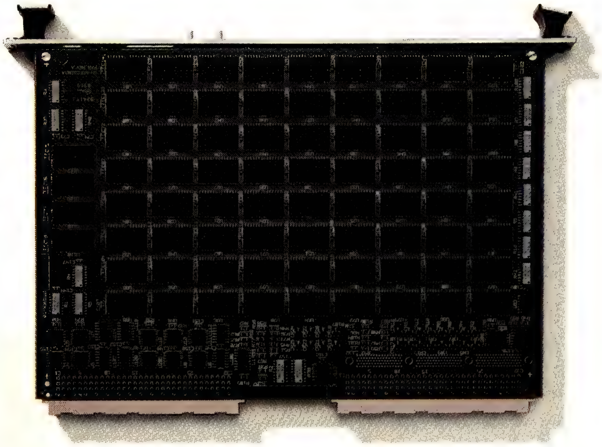
We have a VME solution for almost any type of application. And keep in mind, it's not just what's on the board that counts. It's what's behind it.

Call one of the numbers below for more information.

There Are Two Sides To The Story Of The Most Powerful VME Board Ever Developed.



Front Side



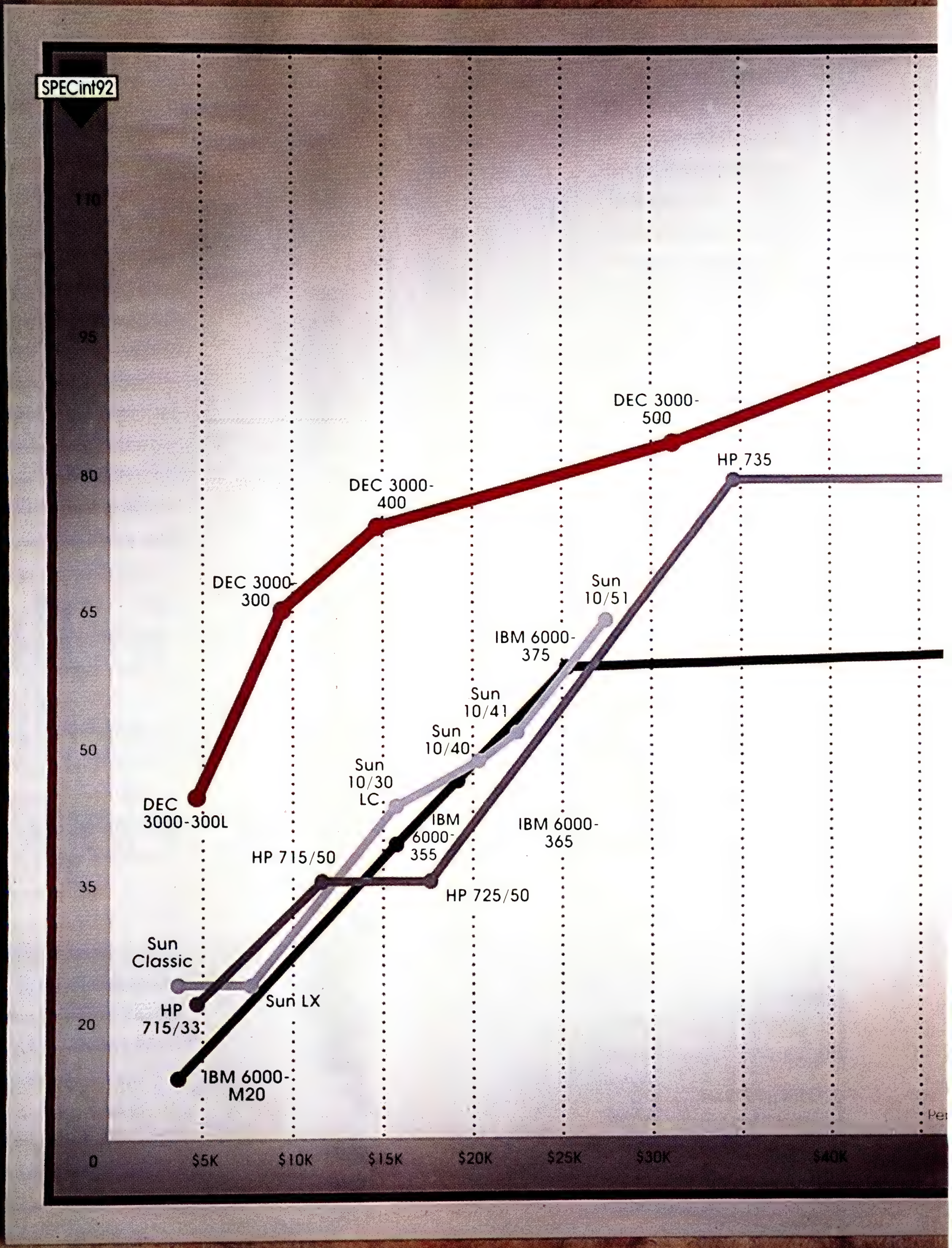
Back Side

AUSTRALIA 61-2-906-3855 • BELGIUM 32-2-718-5582 • FRANCE 33-1-4095-5900 •
GERMANY 49-40-236204-0 • HONG KONG 852-806-2901 • ITALY 39-2-8220-239 •
JAPAN 81-33-280-8461 • SCANDINAVIA 46-8-734-8800 • SPAIN 34-1-345-8005 •
UNITED KINGDOM 44-628-39121

MOTOROLA
Computer Group
Because The Game Has Changed™

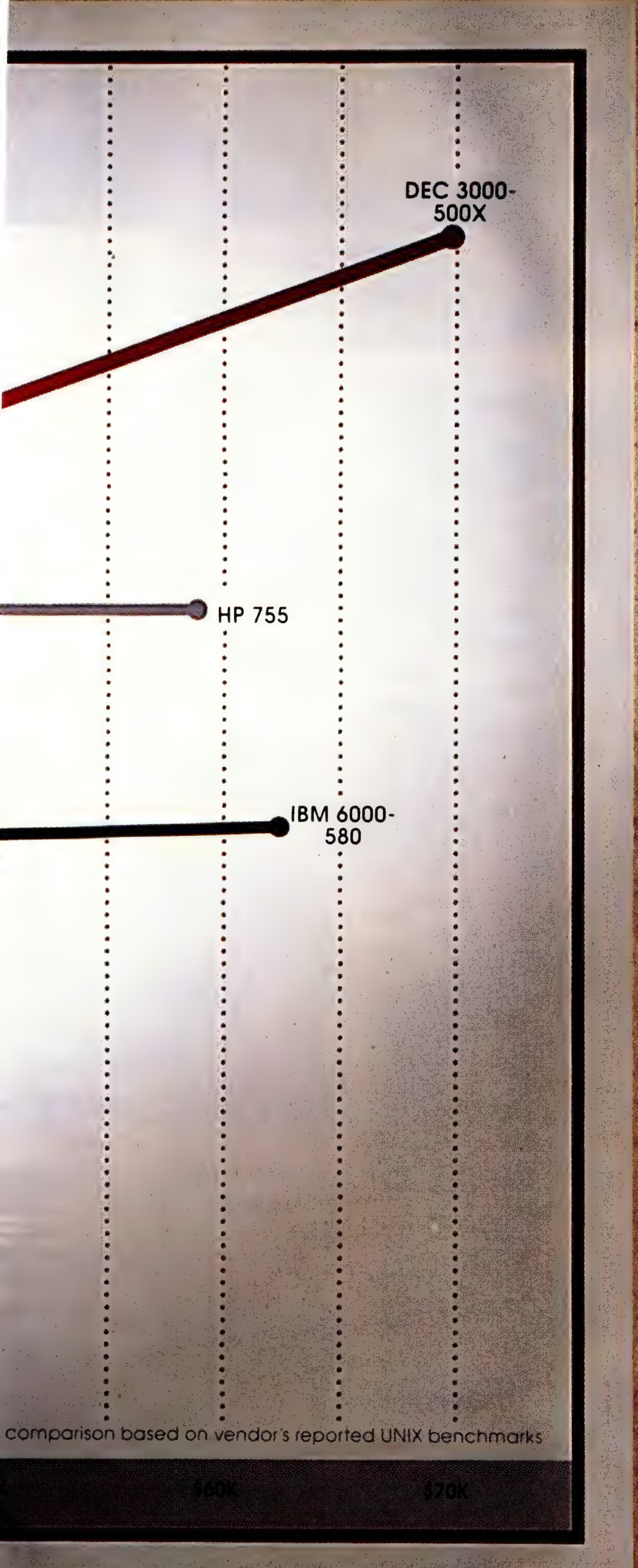
© Copyright 1993 Motorola Inc. Motorola and the Motorola logo are registered trademarks of Motorola Inc.
"Because The Game Has Changed" and "Symmetric Superscalar" are trademarks of Motorola Inc.

CIRCLE 248 FOR U.S. RESPONSE   CIRCLE 249 FOR RESPONSE OUTSIDE THE U.S.



i magine working faster than you ever

© Digital Equipment Corporation 1993. The DIGITAL logo, DEC, the AXP logo and AXP are trademarks of Digital Equipment Corporation. IBM is a trademark of Internationa



DIGITAL ANNOUNCES THREE NEW WORKSTATIONS THAT PUT IBM,™ HP™ AND SUN™ IN THEIR PLACE.

Digital introduces three new members of its Alpha AXP™ workstation family—the world's fastest family of workstations. The DEC™ 3000 Model 300L AXP workstation, the world's fastest for under $5,000. The Model 300, the world's fastest for under $10,000. And the Model 500X—the world's fastest, period. Alpha AXP workstations. Their breakthrough technology is so powerful they can truly increase your productivity and provide solutions you never before thought possible. And all are available now. To find out more about Alpha AXP workstations, our comprehensive trade-in and migration programs, or pre-sales technical assistance, call 1-800-DIGITAL, press "2," and ask for extension 77M. Or, for immediate information via Digital's Alpha AXP Fast FAX, call 1-800-842-7027 in the U.S. and Canada. Or contact your local Digital Representative.

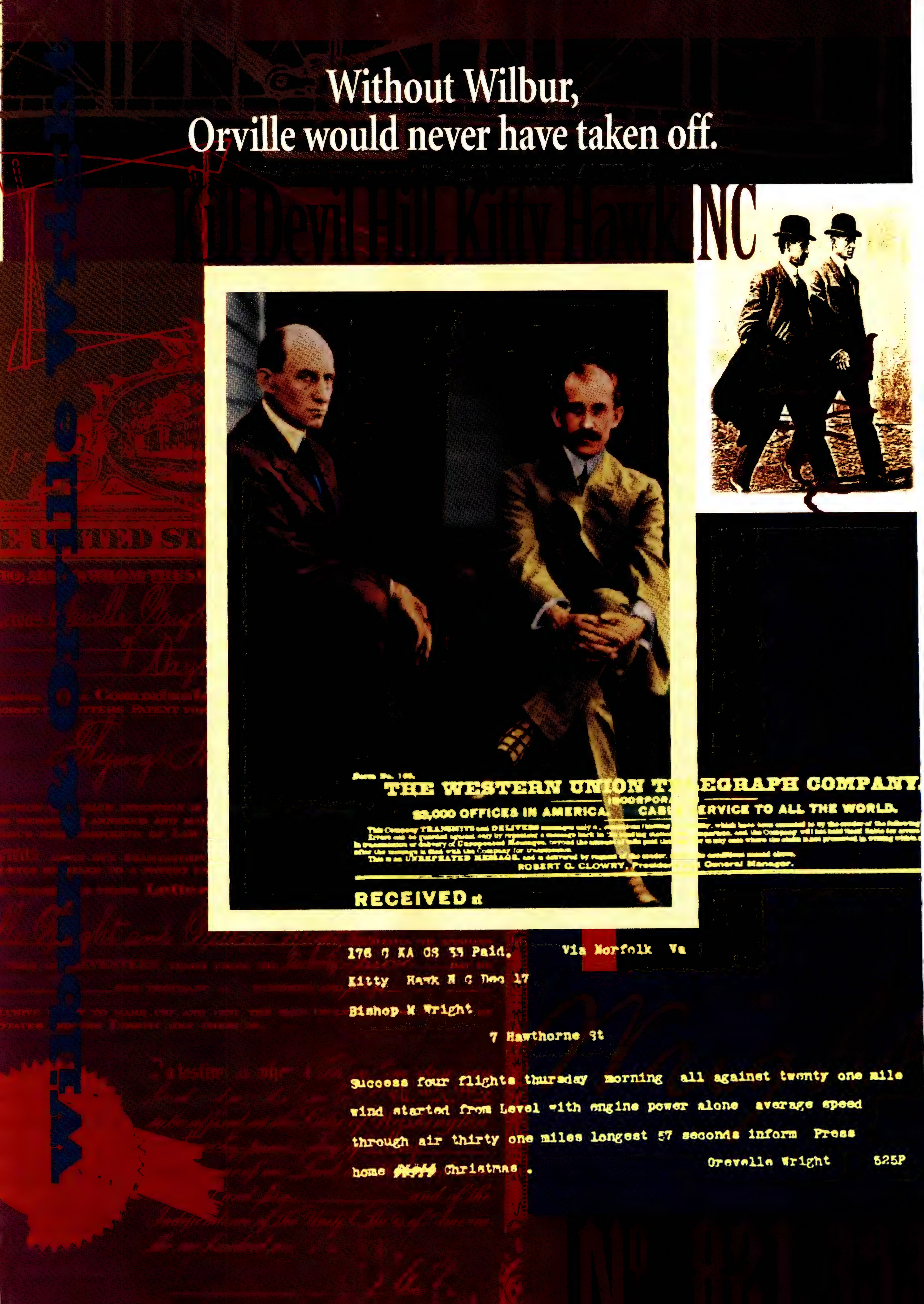
PUTTING IMAGINATION TO WORK

imagined.

digital™

Business Machines Corporation. HP is a trademark of Hewlett-Packard Corporation. Sun is a trademark of Sun Microsystems, Inc.

CIRCLE 114 FOR U.S. RESPONSE CIRCLE 115 FOR RESPONSE OUTSIDE THE U.S.


Without Wilbur,
Orville would never have taken off.
Kill Devil Hill, Kitty Hawk NC
Wilbur & Orville Wright

THE WESTERN UNION TELEGRAPH COMPANY.

23,000 OFFICES IN AMERICA. CABLE SERVICE TO ALL THE WORLD.

ROBERT C. CLOWRY, President and General Manager.

RECEIVED at

176 C KA CS 33 Paid. Via Norfolk Va

Kitty Hawk N C Dec 17

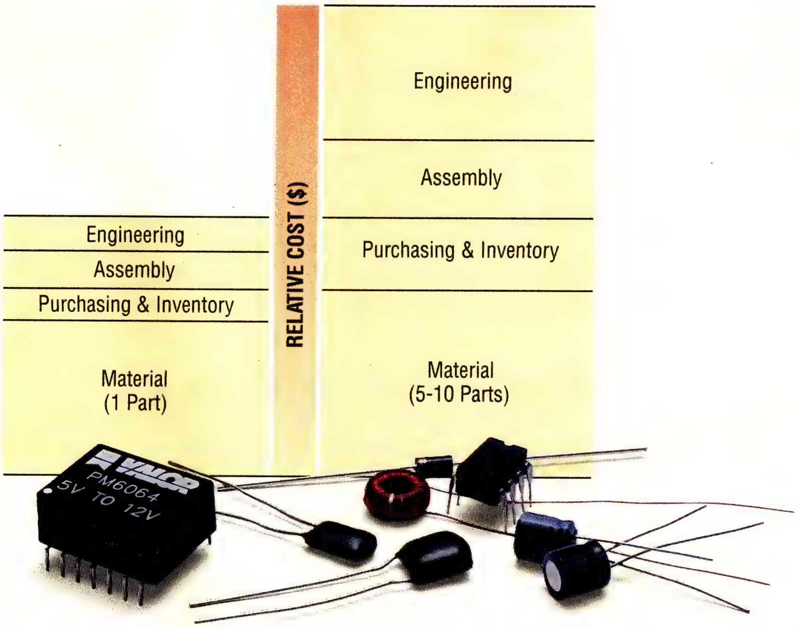
Bishop M Wright

7 Hawthorne St

Success four flights thursday morning all against twenty one mile wind started from Level with engine power alone average speed through air thirty one miles longest 57 seconds inform Press home [illegible] Christmas .

Orevelle Wright 525P

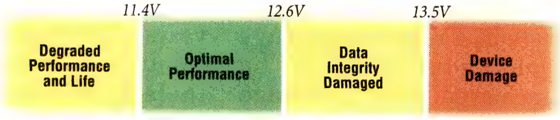
Valor has the power conversion expertise to help get your Flash Memory designs off the ground.



PM6064. The first DC/DC Converter developed for flash memory applications. It saves you money, design time and board space.

Voltage regulation is critical.

The leading manufacturers of flash memory chips all agree that you must have a tightly regulated +12V supply over all operating conditions. Voltages below 11.4V will dramatically extend erase/write operations and voltages above 13.5V, even for periods as short as 20 nanoseconds, can destroy a sensitive flash memory device.



Effect of Vpp variation on flash memory performance.

A single-part, low cost, fully regulated solution.

The PM6064 from Valor Electronics provides VPP to one, two, or more memory chips. It maintains a maximum ±5% output regulation window over *all* operating conditions. The PM6064 is asingle-part solution that ensures the voltage stability flash memory chips demand. And best of all, it saves you valuable design time, money and board space when compared to conventional multipart designs.

Team with a trusted worldwide leader.

Valor Electronics is the world's leading manufacturer of power conversion and magnetic components for data communications and networking applications. Since 1989, Valor has shipped over 10 million application-specific DC/DC converters, including flash memory converters.

Make Valor Electronics your design partner. Call today.

One of our worldwide sales representatives will provide you with an evaluation unit or give you more information about Valor's extensive line of DC/DC converters and magnetic components. Like all good partners, we'll be there when you need us.

VALOR

Products and technology that make a difference.™

Corporate Headquarters
Valor Electronics, Inc.
9715 Business Park Avenue
San Diego, CA 92131-1642
United States
Telephone (619) 537-2600
Facsimile (619) 537-2525

Valor Asia
Valor East Electronics, Ltd.
Room 510, 5th Floor
1 Kornhill Road, Kornhill Metro Tower
Quarry Bay, Hong Kong
Telephone 852-513-8210
Facsimile 852-513-8214

Valor Europe
Valor Electronics GmbH
Steinstraße 68
81667 München
Federal Republic of Germany
Telephone 49-89-4802823
Facsimile 49-89-484743

© 1993 Valor Electronics, Inc. Valor Electronics, the Valor logomark, logotype, part numbers and corporate tag line are trademarks of Valor Electronics, Inc. All other logos, company names or product names are registered trademarks or trademarks of their respective companies.

CIRCLE 278 FOR U.S. RESPONSE

CIRCLE 279 FOR RESPONSE OUTSIDE THE U.S.

500 pC, the maximum charge the IC can collect in one integration cycle. However, the ADC can be configured by the user to perform up to 256 integrations per conversion, resulting in the ability to capture a maximum charge of 128,000 pC.

The converter's specifications, such as noise and linearity, which are given in percentage or ppm of FSR, refer to the full-scale 500-pC charge, and convert easily to full-scale current or voltage. For example, an input current of 0.5 μA integrated for 1 ms results in a full-scale charge of 500 pC.

Voltage inputs have a resistor inserted in series with the input. For example, to handle a full-scale signal of 5 V, selecting a 10-MΩ input resistor achieves a full-scale current of 0.5 μA using a 1-ms integration time. A noise of 1.6 ppm of FSR equals 1.6 ppm multiplied by 500 pC, which equals 0.8 fC. That is, the noise is 1.6 pA or 8 μV.

The maximum average input current captured by the circuit during the minimum integration time of 100 μs is 5 μA for unipolar currents and ±2.5 μA for bipolar currents. As a result, longer integration times are required for lower full-scale currents.

The DDC101's unipolar differential-linearity error is within ±005% of reading ±0.5% of FSR. Unipolar integral-linearity error is within ±0.025% of reading ±2.5 ppm of FSR.

For additional information, call Stephan Baier at (602) 746-7677.

FRANK GOODENOUGH

ENHANCED MAGNETORESISTIVE R/W HEAD PROMISES 50X BOOST IN DISK STORAGE

Although magnetoresistive (MR) heads have recently been incorporated into hard-disk drives, they're still in their infancy. As of now, MR heads boost storage capacity by an order of magnitude over inductive read/write heads, delivering bit densities of 350 Mbits/in.^{2}. On top of that, researchers at the Adstar Div. of IBM Corp., San Jose, Calif., expect standard MR-head technology to permit about another order of magnitude increase in disk storage capacity over the rest of this decade.

However, the need for still-higher-capacity storage compelled Adstar's researchers to develop an enhanced MR technology called "Giant Magnetoresistance," which promises density improvements of 30-to-50-fold. The Giant MR technology uses 20-Å-thick sputtered layers of magnetic nickel-iron (NiFe). These layers are separated by 40-Å-thick non-magnetic silver layers to form a test structure that could eventually be turned into a read/write head *(see the figure)*.

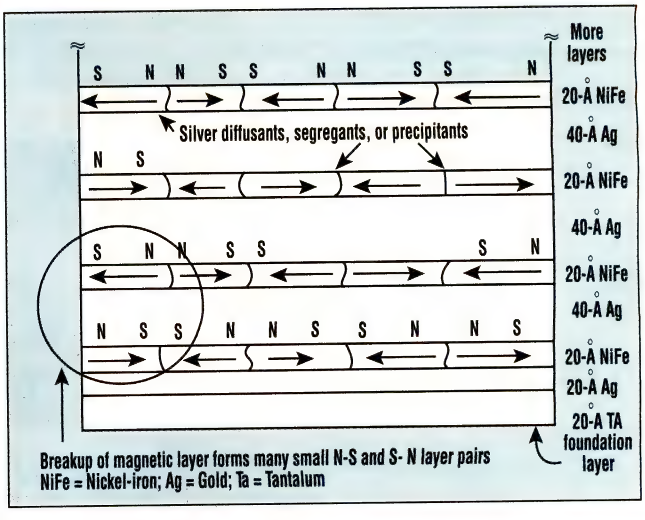
Before the silver and NiFE layers are deposited, a 40-Å tantalum base layer is deposited on the substrate. Next, a half-thickness 20-Å layer of silver is sputtered and the first 20-Å-thick NiFe layer is sputtered on top of the silver layer. Subsequent depositions include four alternating 40-Å-thick silver and four 20-Å-thick NiFe layers. Finally, a 20-Å-thick silver cap and 100 Å of tantalum are deposited.

Next, the material is annealed at just over 300°C, causing the silver atoms to migrate into the grain boundaries of the NiFe layers, and in turn causing the layers to break into small, pancake-shaped regions. The breakup occurs along the grain boundaries, running from top to bottom of the multilayer film and are spaced a few hundred angstroms apart. The silver atom diffusants, segregants, or preciptants break the NiFe film (sort of the same effect as breaking a bar magnet into small pieces) into randomly organized magnetic regions isolated from each other by non-magnetic silver atoms.

The isolated, microscopic, NiFe regions tend to align themselves as anti-parallel N-S magnet pairs when a GMR head passes over one of the fringe areas between two magnetized bit regions on a magnetic disk. The North poles of all small magnetic regions in the GMR head flip directions so that the poles in each layer have the same magnetic orientation. That reorientation produces a large change in the resistance of the multilayered material, giving rise to the "Giant" part of the name.

Thus, with a field strength of just 12 oersteds, a resistance change of about 6% can be achieved. That percentage change is about three times greater than what's achievable with standard Permalloy MR heads. The larger resistance change also translates into about a five-fold improvement in signal size that the head can thus deliver to the supporting read-channel circuits. Furthermore, the larger signal lets designers make additional trade-offs in the read/write channel that could, for example, lead to much higher storage densities. Alternatively, designers could relax some of the very exacting read-channel specs, or select an option between.

Although this scheme shows much promise, IBM will need several more years before incorporating it into disk drives. Nonetheless, the sputtering technology used to fabricate the heads is well-proven, and the thickness of the



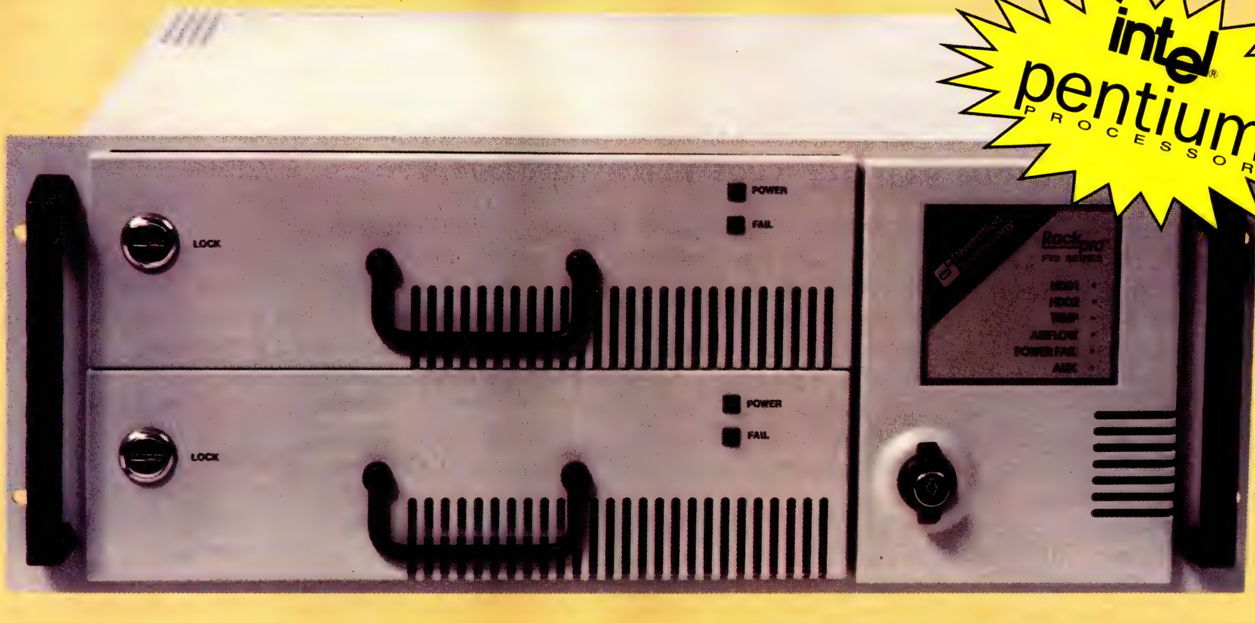
Breakup of magnetic layer forms many small N-S and S- N layer pairs
NiFe = Nickel-iron; Ag = Gold; Ta = Tantalum

The
Passive Backplane
Slot Card Leader Featuring...
Intels Full Line Of Processors

FAULT TOLERANT SYSTEM

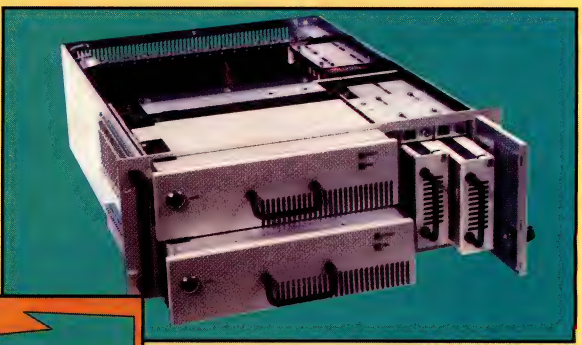
Redundant Power • Hot Swapping • Expansion Capability • CPU Flexibility

intel® pentium™ PROCESSOR



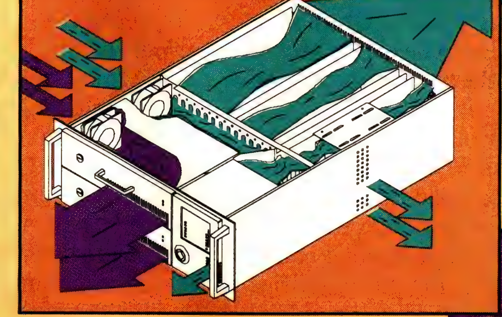
FAULT TOLERANT SYSTEM FEATURES

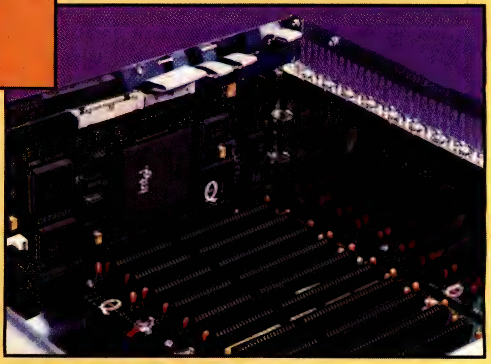
- IBM PC/AT, EISA & /AT PCI LOCAL BUS COMPATIBLE
- UP TO 18 FULL /AT SIZE SLOTS
- UP TO FOUR 5.25" HALF-HEIGHT DEVICES PLUS ONE 3.5" DEVICE
- LOCKABLE FRONT DRIVE ACCESS
- HOT SWAPPABLE, REDUNDANT, LOAD SHARING POWER SUPPLIES
- SEPARATE POSITIVE PRESSURE COOLING SYSTEMS FOR POWER SUPPLIES AND EXPANSION CAGE WITH SNAP-ON AIR FILTERS
- RAID SUPPORT FOR UNIX, NOVELL, OS/2, DOS, WINDOWS NT AND OTHERS
- OPTIONAL HOT SWAPPABLE DRIVES
- OPTIONAL FRONT ACCESS VIDEO & KEYBOARD PORTS



Up to four 5.25" half-height & one 3.5" drive capacity. Two hot swappable, redundant & load sharing power supplies.

Simulated air-flow pattern





Up to 18 Full /AT Slots on Passive Backplane for CPU Expansion. Choose from a selection of DTI Single Board Computers including Pentium™, PCI Local Bus, EISA, 486, 386, & 286 running at speeds up to 66MHz.

Diversified Technology®
An Ergon Co.

U.S.A. - (601) 856-4121 Fax (601) 856-2888
Outside U.S.A. - (201) 891-8718/Fax (201) 891-9629

All products as noted throughout are trademarks of their respective holders.
The Intel Inside Logo is a trademark of Intel Corporation.

intel inside

Call us toll free for orders and information

1-800-443-2667

CIRCLE 116 FOR U.S. RESPONSE
CIRCLE 117 FOR RESPONSE OUTSIDE THE U.S.

deposited layers can vary by a reasonable percentage (unlike some other head technologies that require very exacting thickness controls of the sputtered material). Consequently, IBM expects that manufacturing costs for the Giant MR heads will be comparable to that of standard MR heads.

Disks for Giant MR heads could thus pack 10 Gbits/in.^{2} by the end of the decade. That's like taking the text of roughly 10,000 300-page novels and cramming it onto two sides of a single 3.5-in. platter.

DAVE BURSKY

SIMPLE MICROCONTROLLER-BASED SCRAMBLING SCHEME BLOCKS VIDEO-CASSETTE VIEWING

The current tumult over the easy access that minors have to violent or adult-oriented material available at video stores may soon be assuaged if a new microcontroller-based scrambling scheme is incorporated into videocassettes. The simple scheme, developed by Shapecourt Ltd., Birmingham, West Midlands, England, adds an inexpensive microcontroller, a small RF antenna and low-power oscillator, an infrared (IR) sensor, and a button battery to each videocassette, as well as a small programming station at the checkout counter of each rental outlet.

The basic operation is simple but elegant according to Ray Davis, joint managing director of technology at Shapecourt. In the secure state, the low-power oscillator emits a 3.8-MHz signal of about 50 µW with a one-second-on/three-second-off ratio (an improved modulation scheme that gives the appearance of continuous scrambling is currently in development). When the microcontroller is activated by a coded signal on the IR detector, it turns off the oscillator circuit, deactivating the scrambling process and allowing the tape to be viewed.

If the "scrambled" tape is inserted into a VCR, the low-power RF signal emitted by the embedded antenna is in close proximity to the VCR's read/write (R/W) head. The intermittent bursts from the oscillator circuit "scrambles" the tape signals picked up by the R/W head, constantly interrupting the viewing of the tape.

The built-in battery has a life of about 9 to 12 months—more than sufficient to cover the limited life of a cassette caused by the wear and tear of rental viewing. Such a subsystem may only add less than $1 to the cost of the cassette when tens of millions of intelligent cassettes are manufactured.

The programming in the embedded controller, a low-power PIC16C54 developed by Microchip Technology Inc., Chandler, Ariz., can be configured to suit the application just before blank cassettes are manufactured. That's because Shapecourt elected to use a one-time-programmable version of the MCU. Such programming can include a unique identification number that would allow the cassette to be tracked.

A simple example of how the technology could be applied would be to configure the MCU to turn off for a set period of time (say 24 or 48 hours, for example) so the tape can be viewed by the customer. After the turn-off time period expires, the MCU reactivates the scrambling signal and the tape can no longer be viewed.

A further measure of security that can be added is a sort of "remote control," which the renter can also obtain from the rental store. The store would configure the control with a simple coded sequence, thus allowing a one-button "clicker" to emit an IR-coded pattern. That pattern, when directed at the IR sensor in the cassette, would "lock" the tape after it was viewed, and could potentially unlock the tape to permit additional viewing within the rental period. The locking option would prevent children from viewing tapes left out in the open by adults.

To set up the activation period, the intelligent cassette would be inserted into a simple programming station that could be part of a dedicated checkout stand or a computer-based register. The station could be set up to download various information, such as the title, date and time, period of rental, number of times rented, and so on. Some of the data can be temporarily stored in the embedded MCU's static RAM, because the MCU is continually powered.

The electronic scheme also provides a tremendous benefit to the film companies and to the video stores. First, the film suppliers could use the MCU to prevent advance viewing of a new release by specifying an unlock date. As a result, cassettes could be distributed across a wide area without anyone, even the video-store personnel, from viewing the tape before a preset date. The scheme can even generate new distribution options by creating a total rental period over which the tape can be rented . This can be done by shutting off the scrambling at a certain date and then reactivating the scrambling, say, 3 months after release. This would have the same effect as "pulling" the tape off all store shelves, so as to limit the release period to create demand.

To store owners, it gives them a way to track the tape usage, title popularity, and other factors. In addition, the electronic tracking capability allows new forms of tape distribution between the studios and stores, such as innovative revenue sharing. But the scheme also provides yet another benefit—because the cassette is constantly emitting a low-power RF signal, that signal can be used by sensors to prevent shoplifting. A simple RF detector would be located at the door, looking for the RF signal. And, since the RF signal is deactivated once a tape is rented, there's virtually no possibility of a false accusation. If a tape is purchased, the scrambling scheme could be permanently be disabled.

For more information, contact Brian Gordon at Shapecourt at (011) 44 21 308-6736, and Jim Nickerson at Microchip at (602) 786-7509.

DAVE BURSKY

One-stop shielding.

For half a century, Instrument Specialties has led the way in EMI/RFI shielding. Today we are the supplier of choice for beryllium copper (BeCu) gasketing. BeCu offers formidable tensile strength, exceptional stability, superior thermal/electrical conductivity and ease of fabrication.

One-stop shopping for *all* your EMI shielding.

But more than 250 BeCu configurations were just the beginning. Instrument Specialties now offers wire mesh, conductive elastomers, vent panels and air filters. A complete line of EMI/RFI shielding solutions is on our shelf and ready to ship. Plus specialized platings and custom capabilities.

We want to be up front about our design help.

Instrument Specialties engineers will work with yours right from the drawing board stage. Our Finite Element Analysis simulates real-life working conditions. With CAD/CAM, photoetching, wire EDM and other state-of-the-art technologies, we help you achieve a total shielding solution. And a lot fewer headaches.

Million dollar expansion of testing capability.

A major capital investment has dramatically upgraded our ability to perform certified testing for all worldwide EMC specifications and standards in compliance with ISO-9000 requirements. At our facility or yours. For full facts... for our new color brochure...for one-stop shielding, please write, call or fax today.

SEE US AT WESCON BOOTH # 6413, 6415

Where Shielding is a Science

Instrument Specialties

Headquarters: Delaware Water Gap, PA 18327-0136
TEL: 717-424-8510 FAX: 717-424-6213

Western Division: 505 Porter Way, Placentia, CA 92670
TEL: 714-579-7100 FAX: 714-579-7105

European Division: Champ Tignée 34, 4671 Barchon, Belgium
TEL: +32-41-877170 FAX: +32-41-877175

Japan: Kitagawa Industries Co., Ltd., 052-261-5521; **Taiwan:** Intermark Taiwan Co., Ltd., 052-261-2740; **Korea:** Korea Microwave Sales Co., 82-331-33-9985; **Singapore, Malaysia, Indonesia, Thailand, Philippines:** Glocom Mktg Pte Ltd., 65-353-1791; **Australia, New Zealand, Pacific Islands:** RFI Industries Pty Ltd., 61-3-762-6733; **India:** RFI Electronic Ind. Ltd., 91-842-848358; **Hong Kong:** Bel Components Ltd., 852-327-6880

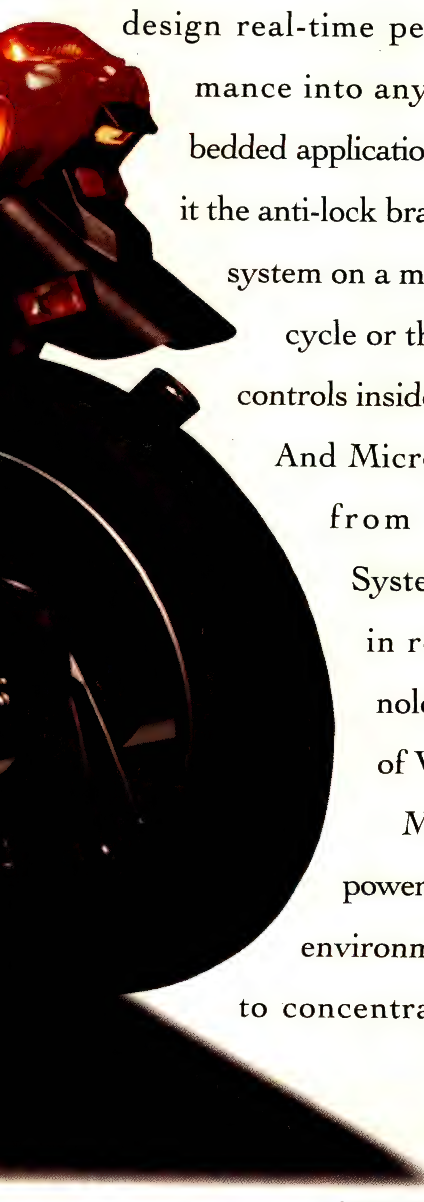
CIRCLE 342

Now the same real-time tech
full of traffic lights can stop

© Wind River Systems, Inc. 1993. 1010 Atlantic Avenue, Alameda, CA 94501. MicroWorks is a trademark of, and VxWorks is a registered trademark of Wind River Systems, Inc.

nology that controls a city
a street bike in its tracks.

INTRODUCING MICROWORKS™—THE REAL-TIME DEVELOPMENT SYSTEM FOR EMBEDDED APPLICATIONS.



Everywhere you go, everywhere you look, the world is working in real time. And embedded systems are no exception.

Now with MicroWorks, you can design real-time performance into any embedded application–be it the anti-lock braking system on a motorcycle or the sophisticated controls inside a fax machine.

Embedded real time comes out of its shell.

And MicroWorks comes from Wind River Systems,™ the leader in real-time technology and creator of VxWorks.®

MicroWorks' powerful development environment allows you to concentrate on writing your application. And since it's the only system that ships with a full complement of integrated tools, you can begin right away. To speed the process even further, MicroWorks' integrated ROM monitor lets you develop and debug code without the OS. And because MicroWorks' core system uses less than 20K, there's more room on the target for your application.

Also, MicroWorks and VxWorks are 100% compatible. So you can finally standardize on a single, reliable development environment. Perfect for developers with a wide range of projects.

Call your local sales office now for a free *Get The Works* package, and we'll send along a wall-sized poster of this photo before you can say "The Real Power In Real Time."

WIND
RIVER
SYSTEMS

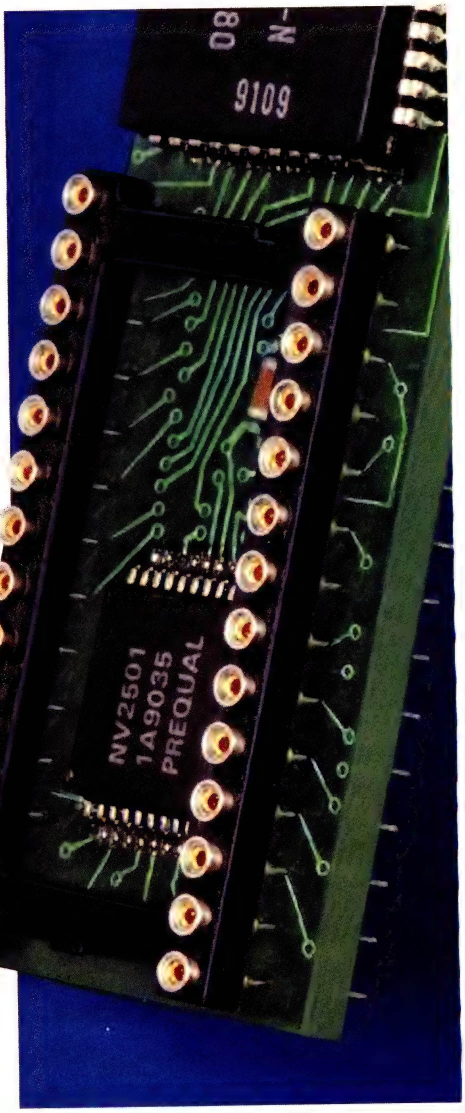
THE REAL POWER IN REAL TIME.

Sales Offices: **WRS EC Headquarters,** 27 Avenue de la Baltique, Bâtiment B4, LP739, Z.A. de Courtaboeuf, 91962 Les Ulis Cedex, France, 33-1-69-07-78-78; **WRS GmbH,** Freisinger Straße 34, Postfach 1320, W-8045 Ismaning, Germany, 49-89-96-09-49-46; **WRS UK Ltd.,** Aston Science Park, Aston Triangle, Birmingham B7 4BJ, United Kingdom, 44-21-359-0981.

CIRCLE 357 FOR U.S. RESPONSE **CIRCLE 358 FOR RESPONSE OUTSIDE THE U.S.**

“Why didn't I think of that?”

“I thought it was impossible to solve four redesign problems with one interconnect. Then I talked to Aries…”



THE PROBLEM:

“Get this: We just finished a run of 500 new boards when our top designer had a breakthrough. He could increase board capability by 200% at almost no cost increase (meaning a ton of extra margin for us!). But the redesign would require:

(1) a switch to an SMT device;
(2) a re-routing of the circuitry;
(3) an additional surface mount component; and
(4) a 28-pin DIP package – all in the same space!

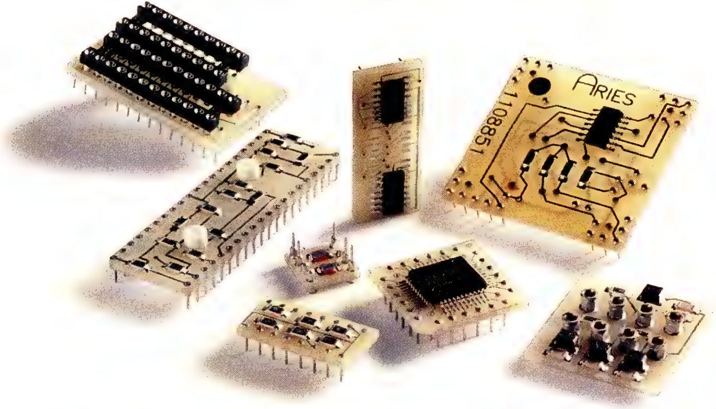
Impossible? That’s just what we thought.

THE SOLUTION:

We had heard about Aries' problem-solving skills, so we gave 'em a call. They talked to our designer and, in a matter of hours, came up with exactly the solution we needed. Their Correct-A-Chip™ semi-hybrid daughter board solution let us do everything we wanted… at a cost so low that it didn’t even impact our total cost… and in almost no time at all.

THE PROOF:

Listen, these guys aren’t magicians, but it sure seems that way. If you have a problem that needs a packaging/interconnect solution, call Aries. They can do things for you that you won’t believe… until you see for yourself.”



ARIES®
ELECTRONICS, INC.

P.O. Box 130 Frenchtown, NJ 08825
(908) 996-6841 FAX (908) 996-3891

Sensible Solutions. . . Fast!

CIRCLE 92 FOR U.S. RESPONSE CIRCLE 93 FOR RESPONSE OUTSIDE THE U.S.

APPLIED TECHNOLOGY DOMINATES WESCON/93

WESCON PROGRAM AIRS CHALLENGES AND SOLUTIONS FOR EXPLOITING EMERGING TECHNOLOGIES.

MILT LEONARD

Wescon returns this year to San Francisco's Moscone Convention Center, Sept. 28-30, again giving high visibility to the application of advanced technologies. Many of these advanced technologies, developed by aerospace and defense contractors, are being directed at new mass-market opportunities like electric vehicles. This is an important consideration as companies attempt to redirect their business goals. This year's program, consisting of 28 technical sessions, 48 panel discussions and seminars, and 16 half-day tutorials, offers a range of timely subjects. These include portable power and energy management, programmable logic, fuzzy logic, neural networks, machine vision, data compression, and embedded PCs.

Many topics cut across a number of engineering disciplines. Some, however, such as power and energy management, are particularly important in the communications sector—that's because portable electronic devices such as cellular telephones, laptop computers, and recorders continue to revolutionize rechargeable-battery technology. In fact, two sessions are devoted to advances in small batteries for portable electronics.

In Session 10, Valence Technology Inc., of San Jose, Calif., will open the program with an introduction to battery technology and a review of the characteristics of various types. This is followed by Sony Energytec Inc.'s (Fukushima, Japan) detailed description of lithium-ion rechargeable batteries.

Nickel-metal-hydride (NiMH) batteries are an increasingly attractive alternative to other disposable types because they're environmentally safe. In session 10, Duracell Inc., of Needham, Mass. will discuss the nickel-metal-hydride cells it developed with the same voltage characteristics as nickel-cadmium (NiCd) batteries, but featuring 25% to 40% more power. SAFT America Inc., of Valdosta, Ga., on the other hand, argues in the same session the case for the venerable NiCd battery, citing the advantages of low cost, reliability, and design flexibility in keeping pace with changing requirements

ELECTRICAL CONNECTORS FIGHT DIRT, MOISTURE

Two low-cost cylindrical connectors have sealed construction for operating in harsh environments. Developed for use in fluid and chemical environments, the BVD connector has triple redundant wire seals and a silicone grommet with seal. This connector comes in six sizes ranging from less than 1-in. to just over 1.5-in. diameters. Six shell sizes and twelve contact arrangements are offered, with contact sizes for wire gages form 12 to 26 AWG. Pricing starts at $5 each. The MMP connector comes in a nonconductive housing with a 0.600-in. or 0.750 outside diameter. Military-type contacts are gold-plated with crimp, soldered, or extended pins for circuit-board application. Current ratings are from 5 to 13 A, and voltage ratings are from 750 to 1000 Vrms. Pricing is from $2 to $10, depending on configuration and quantity.

Deutsch Commercial Products Div., Banning, Calif.; (909) 849-4568. CIRCLE 484

■ *Booth 6279*

GAS-PLASMA DISPLAY HAS 50,000-HR LIFE

Gas-plasma dot-matrix displays with a 50,000-hr. life can be made with round, square, or rectangular pixel shapes. Called Plasmadot, the displays have a neon-orange color, a 130-degree viewing angle, a 50 ft.-L brightness, and are packaged in a flat-panel housing. The orange color can be modified with red, amber, or neutral filters. Pixel sizes range from 0.015 in. to 0.001 in. with a minimum inter-pixel spacing of 0.100 in. Available sizes are 128 x 32, 128 x 64, and 280 x 120 pixel arrays. Custom arrays can be made in panel sizes up to 18 x 24 in.

***The Cherry Corp.,** Waukegan, Ill.; (708) 360-3413.* **CIRCLE 485**
■ *Booth 6425*

for portable power. In addition, advanced charger designs are described by Benchmarq Microelectronics, Inc., Carrollton, Texas.

In session 14, high-energy planar batteries are focused on by Portable Energy Products Inc., of Scotts Valley, Calif. Portable Energy Products specializes in advanced planar packaging of small, sealed lead-acid batteries for notebook computers. In the same session, zinc air batteries constitute the subject of a paper from AER Energy Resources Inc., of Smyrna, Ga. The session also includes a discussion on recent developments and applications in lithium rechargeable battery technology by Moli Energy Ltd., of Maple Ridge, B.C., Canada. Finally, battery legislative and regulatory issues are covered by a representative from the Portable Rechargeable Battery Association, of Atlanta, Ga.

Session 18 treats the related subject of recently developed techniques for optimizing power sources in portable electronic products. Micrel Semiconductor, of San Jose, Calif. uses the cellular telephone as an example to illustrate techniques for extending battery life. Next, Micro Linear Corp., of San Jose, Calif., will introduce new integrated circuits and power-control techniques for battery-powered systems. The session ends with a discussion of unique control schemes for extending battery life by Maxim Integrated Products Inc., of Sunnyvale, Calif.

PROGRAMMABLE LOGIC

Field-programmable gate arrays (FPGAs) combine the benefits of VLSI logic with user programmability. Session 11 expounds on these devices, examining the latest advances in the architecture of antifuse-based FPGAs. Actel Corp., of Sunnyvale, Calif., will open the program with a discussion on how to design an efficient high-performance FPGA. This is followed by a paper from Crosspoint Solutions Inc., of Santa Clara, Calif., on how interconnect technology dictates architecture choices for FPGAs and how each architecture type impacts the way FPGAs are designed. Issues covered include gate arrays versus FPGAs, interconnect technology versus cell granularity, timing control and predictability, performance, gate density, and utilization.

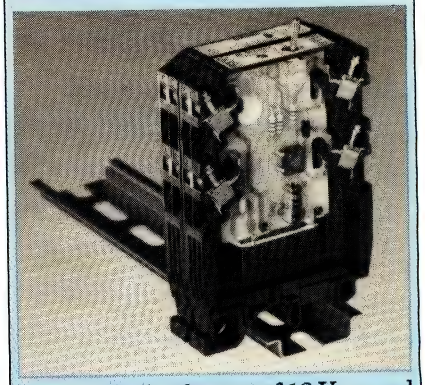
Traditionally, field-programmable gate arrays have provided glue logic in several forms. With increasing clock rates and integration levels, advanced devices are now implementing entire subsystems. In a unique FPGA application, QuickLogic Corp., Santa Clara, Calif., designed a 16-bit RISC CPU that combines datapath, state-machine, and arithmetic circuits in the company's QL16x24 device. Described in session 11, the CPU includes a streamlined RISC core, a register file, an ALU, an on-chip instruction cache, and a memory management unit.

In the session's final presentation, VLSI Technology Inc., of Tempe, Ariz., will discuss how programmable antifuse technology provides user configurability in ASIC-based system design to optimize performance within varying environments, change peripheral interfaces, and modify system code. Highlighting VLSI Technology's pFSB technology, the paper covers via parasitics, PROM block structures, test and programming support, and configurability.

The subject of FPGAs continues in Session 15, which focuses on advances in SRAM-based FPGA technology. Xilinx Inc., San Jose, Calif. opens the session by introducing several new FPGA devices with architectural extensions to existing device families. These products are designed to meet specific require-

SPDT RELAY MODULE IS RAIL MOUNTED

A 6-A, 250-V ac SPDT relay comes in a 11.5-mm interface module that mounts on a rail in high-density control panels. Twenty six modules can mount side-by-side within a foot of rail. Double wire clamps for the relay coil and common contact allow easy daisy-chaining without connecting multiple wires to a wire clamp. The Series 30000 interface modules operate on coil voltages of 12 V ac and dc, 48 V ac and dc, 115 V ac, and 230 V ac. An integral LED indicates when the relay coil is energized. For ac loads, the contacts can switch from 5 mVA to 1500 mVA. For dc loads, switching capacity is from 5 mW to 192 W. Available versions include a unit with a manual override coil-voltage switch for testing, and a version with 3-A dpdt contacts. All modules are hermetically sealed.



***Entrelec Inc.,** Irving, Tex.; (800) 431-2308.* **CIRCLE 486**
■ *Booth 1831-1833*

Lexmark announces fiendishly clever plots.

The IBM Color Jetprinter PS, $3199.

If you find color pen plotters too slow, too expensive, and too temperamental, here's the solution in one fell swoop: the IBM® Color Jetprinter PS 4079, by Lexmark.

Its quick, RISC-based engine lets even complex plots unfold with amazing speed. Its fine line weights, 360 dpi resolution, and brilliant color make CAD/CAM drawings into precise works of art. (It also delivers near-laser-quality text.) GL plotter emulation is built in. So is Macintosh and PC connectivity, PostScript® compatibility, and 11"x 17" paper handling.

And at just $3199, it delivers price/performance that makes any other kind of plotting look hopelessly dull.

The Color Jetprinter PS comes from Lexmark, the independent, worldwide company formed from a division of IBM. To order, or to find your nearest dealer, call 1 800 358-5835 (in Canada, 1 800 663-7662).

CIRCLE 144 FOR U.S. RESPONSE

CIRCLE 145 FOR RESPONSE OUTSIDE THE U.S.

IBM Personal Printers by

LEXMARK™

Make Your Mark

EPA POLLUTION PREVENTER

MSRP; dealer prices may vary. IBM is a registered trademark of International Business Machines Corporation in the U.S. and other countries and is used under license. PostScript is a registered trademark of Adobe Systems Incorporated. Macintosh is a registered trademark of Apple Computer, Inc. Lexmark is a trademark of Lexmark International, Inc. ©1993 Lexmark International, Inc.

THE IBM COLOR JETPRINTER PS: COLOR MADE BRILLIANTLY CLEAR.

ments, such as higher speed, more I/O, or lower power. A new SRAM-based FPGA architecture devised by AT&T Bell Laboratories, Allentown, Pa., offers dense layouts for applications previously reserved for gate arrays. AT&T describes the design techniques used to get good random-logic packing, high-density data paths, and high speed in the company's Optimized Reconfigurable Cell Array (ORCA).

Designs requiring fast time-to-market and up to 5000 gates usually are implemented with either FPGAs for high register counts, low standby power, and in-circuit configurability. They may also be implemented with erasable PLDs (EPLDs) when predictable interconnect delays and ease-of-use are required. A presentation by Altera Corp., of San Jose, Calif., in session 11 will demonstrate how the benefits of both device types are combined in the Flexible Logic Element Matrix (FLEX) family of programmable logic devices. The family spans eight devices that range in density from 2500 to 24,000 usable gates.

Another architectural approach is described by Motorola Semiconductor Sector, of Mesa, Ariz., in session 11. Motorola Semiconductor Sector proposes a reprogrammable, partitioned fine-grained core-cell technique coupled with timing-driven automated place-and-route software. According to Motorola, high performance depends more on the richness of the routing resources rather than on granularity. Intel Corp., Folsom, Calif., wraps up this session with a description of its SRAM-based FLEXlogic FPGA family with on-chip nonvolatile memory.

The subject of programmable-logic technology extends through Session 19, which deals with complex programmable logic devices (CPLDs). A good overview on the design issues associated with in-system programmability is given by Lattice Semiconductor Corp., Hillsboro Ore. The company reviews the technology and examines such issues as prototyping, manufacturing, reconfigurability for testing, functional reconfigurability, and device security. Several vendors use this session to launch new PLD families: the MACH family designed by Advanced Micro Devices Inc. Sunnyvale, Calif.; the MAX 7000 family from Altera, National Semiconductor Corp.'s (Santa Clara, Calif.) MAPL 244 family, and the 7300 family of EPLDs developed by Xilinx.

Although the art of designing elec-

STP WIRING ENHANCES IBM CABLING SYSTEM

A new line of shielded twisted-pair copper cables comply with the Type 1A, 2A, 6A, and 9A extended specifications for the IBM cabling systems. All of the cables support IBM's 100-Mbits/s FDDI networks on STP. The cable specification also supports 550-MHz video applications operating with the existing IBM F-Coupler. Type 1A is a two-pair, shielded data cable; Type 2A cable has six pairs (two data, four voice). Type 6A is a two-pair, shielded office cable with a striated jacket; Type 9A has two twisted pairs with an overall shield.

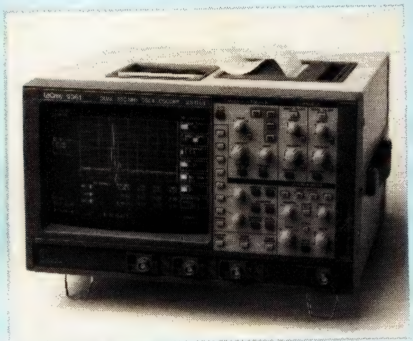
All cables feature an overall black jacket with a ripcord and all are available with nonplenum and plenum constructions. All versions also conform to NEC and CSA standards, meet IEEE 802.5 specifications, and are ETL verified.

***Belden Div. of Cooper Industries**, Arlington Heights, Ill.; (317) 983-5200.* **CIRCLE 487**

■ *Booth 6737-6739*

300-MHZ DIGITAL SCOPE HAS ONE-SHOT SAMPLING

Two independent digitizers running at rates up to 2.5 Gsamples/s accurately characterize input signals to the 300-MHz Model 9361 digital storage oscilloscope in real time. One-shot sampling can be triggered by a variety of functions, including glitch, pulse width, interval width, state- or edge-qualified, dropout, and TV triggering. Variable hold-off by time or by number of events is also possible. The digital storage oscilloscope is programmable through GPIB and RS232-C interfaces. Optional interfaces include Centronics and a PCMCIA 68-pin interface for memory cards with densities of up to 4 Mbytes. An optional 3.5-in. floppy-disk drive is for waveform storage or instrument setups on 1.44-Mbyte or 720-Mbyte DOS-formatted disks, which may be read on any PC display. An optional internal printer is also available. Pricing for the digitizers starts at $8990 each, and delivery is six weeks ARO.



***LeCroy Corp.**, Chestnut Ridge, N.Y.; (914) 578-6020.* **CIRCLE 488**

■ *Booth 7261-7263*

tronic systems continues to be reshaped by the conflicting demands of greater system complexity and shorter time to market, digital-logic synthesis remains the key design tool for producing gate-level implementations of some higher-level hardware-description languages (HDLs). Presentations in Session 4 examine state-of-the-art digital-logic synthesis. Following a technology overview by Xilinx, Cadence Design Systems, San Jose, Calif., discusses synthesis for advanced ASIC design, with a focus on challenges presented by 0.5-µm processes. Mentor Graphics Corp., Wilsonville, Ore., then demonstrates timing-driven design for ASICs, and Viewlogic Systems Corp., Santa Clara, Calif., discusses the challenge of mapping to complex library models.

MINC Inc., Colorado Springs, Colo., delves into the advantages and drawbacks of using an HDL like VHDL. Style paradigms, implementation issues, and conversion to silicon are all discussed. The session ends with a look beyond logic synthesis to high-level design, presented by Synopsys Inc., Mountain View, Calif.

FUZZY LOGIC, NEURAL NETS

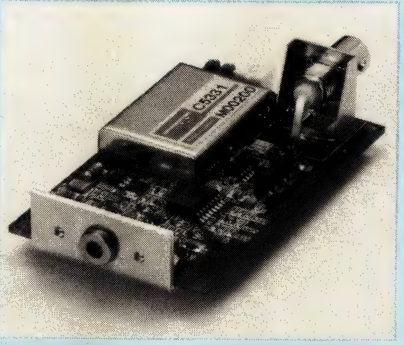
Two conference sessions deal with one of the most significant developments in the field of computer sciences—fuzzy logic. Addressing ongoing advances in fuzzy logic, Session 21 opens with an overview from Togai InfraLogic Inc., Irvine, Calif., which explains basic concepts such as fuzzy sets, fuzzy operators, fuzzy rules, fuzzy inference, and defuzzification. A more philosophical examination of the technology is given in a paper by the Motorola Center for Emerging Computer Technologies, Austin, Texas, which proposes a new approach to problem solving using neural/fuzzy technologies.

Defuzzification in a fuzzy rulebase system transforms an action expressed in fuzzy terms into value that can be executed. A paper from The Huntington Group, Menlo Park, Calif. describes the strengths and weaknesses of the three most popular defuzzifaction techniques, and introduces two other methods. Other papers in this session include a discussion of fuzzy logic and probability from HyperLogic Corp., Escondido, Calif., and a review of the evolutionary optimization of fuzzy rules by the University of Stuttgart, Germany. The final presentation discusses how neural networks can be employed to detect frequency in speech signals.

Additional fuzzy-logic applications are presented in Session 25. The Motorola Microcontroller Technology Group in Austin discusses the requirements of fuzzy logic for control applications, and describes the structure of a general-purpose, fuzzy-inference program for use in 8-bit microcontroller systems. In a commercial application, Togai InfraLogic expounds on a fuzzy expert-system

AVALANCHE-PHOTODIODE MODULES OPERATE ON 5 VOLTS

The C5331 Series avalanche-photodiode sensor modules include a high-speed current-to-voltage amplifier and a 5-V dc power supply on a board the size of a business card. For use in bar-code readers, laser readers, optical range finders, and optical communications systems, the modules come in six versions with active areas ranging from 0.2 to 5 mm in diameter. The temperature-compensated power supply can stabilize gain to ±2.5% at 25 C, and eliminates ripple. Typical specifications include a spectral response of 100 to 1000 nm, peak wavelength of 800 nm, radiant sensitivity of 0.8 A/W, and temperature stability of ±2.5%. The modules are available for immediate delivery.



***Hamamatsu Corp.**, Bridgewater, N.J.; (908) 231-0960.*

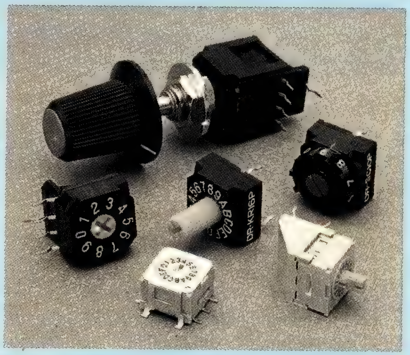
CIRCLE 489

■ *Booth 1250-1254*

ROTARY DIP SWITCHES ARE BINARY-CODED

Rated at 100 mA for 5-V dc switching or 50-V dc nonswitching, a line of rotary binary-coded rotary switches are available in panel, through-hole, and surface-mount configurations. Screwdriver-, shaft-, dial-, and knob-actuated models can be set for real code, complement code, or gray-code outputs and decimal or hexadecimal settings.

Sealed construction makes possible automated wave-soldering and washing operations. The actuator knobs are available either in black or with color-coded tips. Crimped straight and right-angle terminals for board mounting conform to standard 0.100-in. grids and DIP sockets.

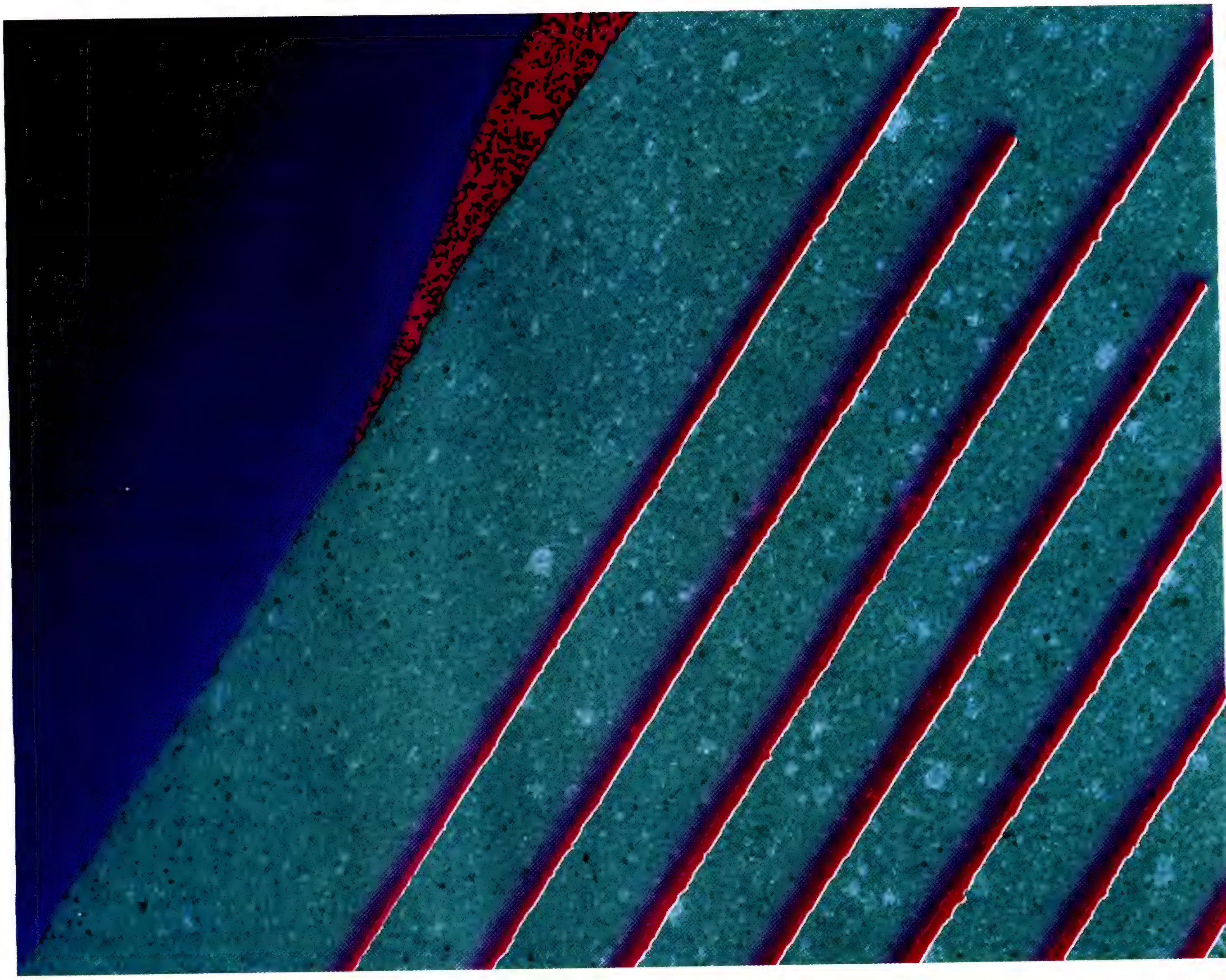


***NKK Switches**, Scottsdale, Ariz.; (602) 991-0942.* **CIRCLE 490**

■ *Booths 6849, 6851*

S+M
COMPONENTS

Siemens Matsushita Components



Varistors to the fore

When you have valuable electronic circuitry that needs looking after, leaving things to a guardian angel can be a little risky. Look to our varistors instead, and how they can sustain all possible kinds of flashover from 4 right up to 3500 V. In industrial control and consumer electronics, just like in telecommunications or automotive load dump.

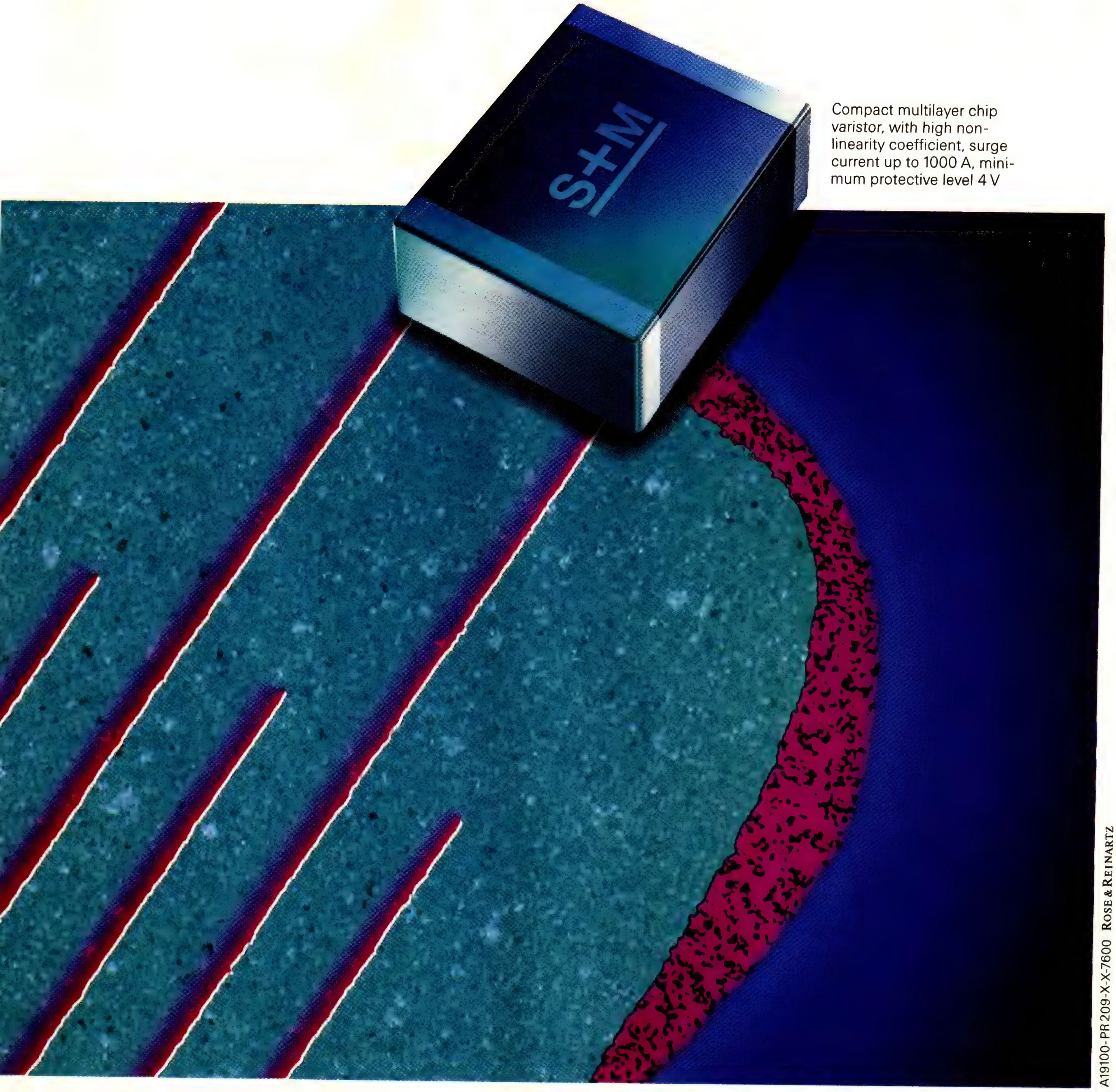
The varistor line-up from S+M Components includes block and disk models, plus SMDs of course. So all the capabilities are there for a certain and sure application match. Founded on the know-how and expertise generated by our technology center for ceramic components in Austrian Deutschlandsberg.

S+M Components is right up front in terms of quality too, with ISO 9001 certification for development, design, production, assembly and service.

S+M Components means playing safe and staying safe – throughout the whole variety of ceramic components.

Write to

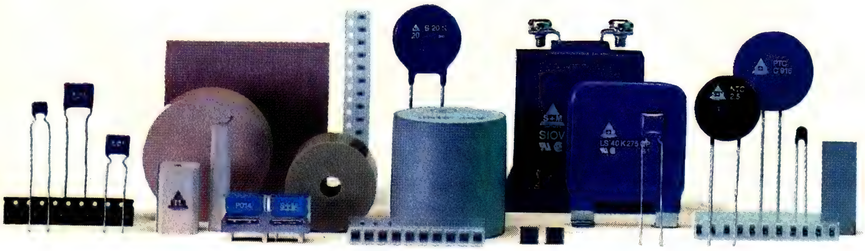
Siemens Matsushita Components
GmbH & Co. KG
Marketing Communication
P.O.B. 801709
D-81617 Munich
quoting "Ceramic Components"



Compact multilayer chip varistor, with high nonlinearity coefficient, surge current up to 1000 A, minimum protective level 4 V

Longitudinal micrograph of a multilayer chip varistor: comb-like electrodes of noble metal ensure effective voltage limiting.

A19100-PR209-X-X-7600 Rose & Reinartz



There are more than 6000 different models in our range of ceramic components

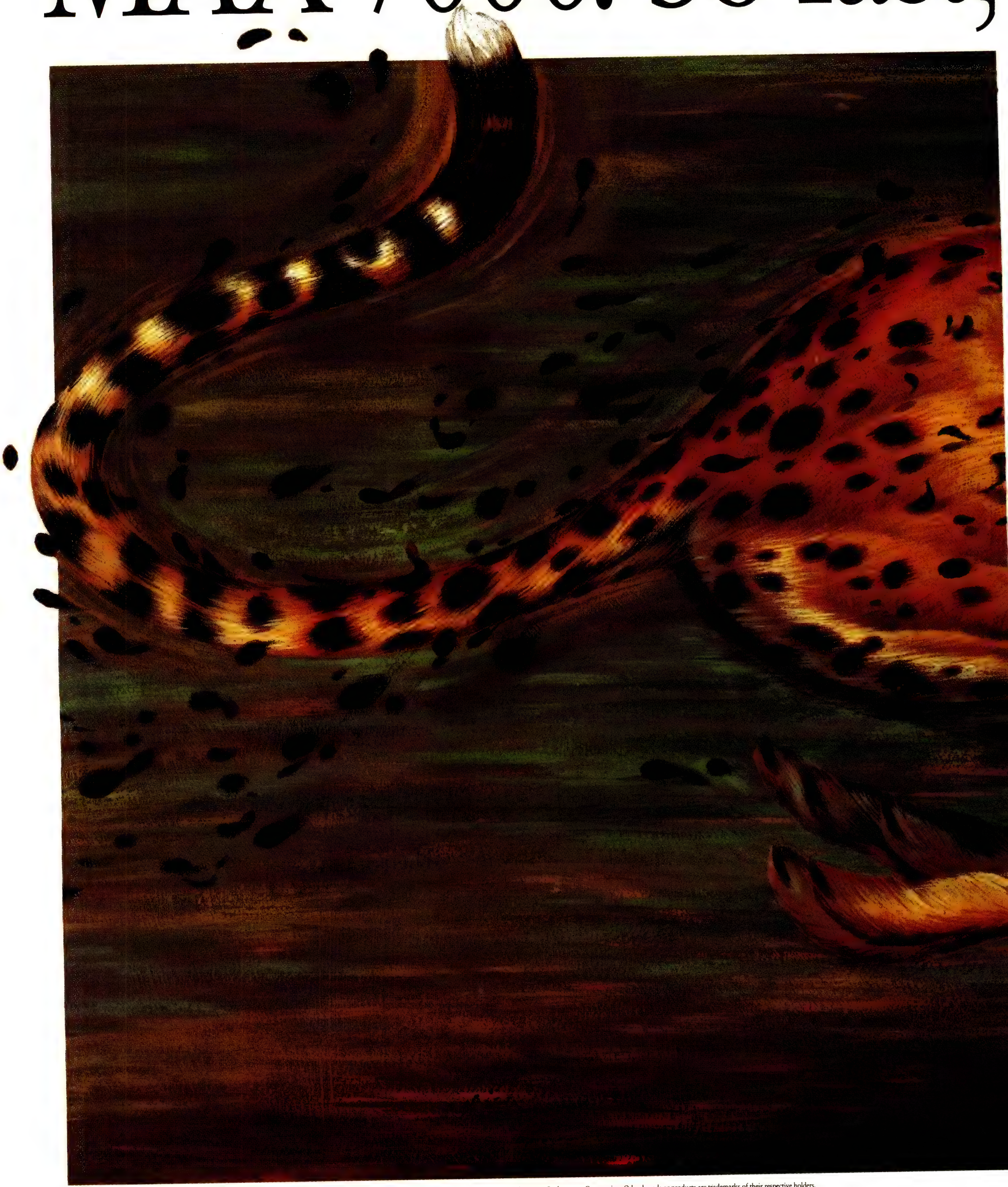
- thermistors
- dielectric resonators and filters
- varistors
- ceramic capacitors
- resistors

The components make it – Siemens Matsushita Components

CIRCLE 206 FOR U.S. RESPONSE

CIRCLE 207 FOR RESPONSE OUTSIDE THE U.S.

MAX 7000. So fast,



© 1993 Altera Corporation. Altera, MAX 7000, FLEX and MAX+PLUS II are trademarks of Altera Corporation. PREP is a trademark of the Programmable Electronics Performance Corporation. Other brands or products are trademarks of their respective holders.

anything is possible.

In the jungle of programmable logic, many claim to be the fastest. But, as the PREP™ benchmark results confirm, it's Altera's MAX 7000 family that sets the pace. With pin-to-pin delays as low as 7.5 ns and in-system performance up to 125 MHz, any of the eight MAX 7000 devices can put you ahead of the pack.

However, speed isn't the only reason for designing with MAX 7000. You also need the choice of multiple devices to get those designs up and running. With a range of 1,200 to 10,000 available gates, there's a MAX 7000 device that's just right for your application.

The MAX 7000 family gives you the most predictable architecture available. Its high-speed interconnect provides consistent, deterministic timing—something you won't find in FPGAs.

The MAX 7000 family even includes a 3.3 volt version for those power-critical applications.

And with devices ranging in size from 44- to 208-pins, MAX 7000 has the highest pin-to-logic ratio of any programmable logic family. Of course, we offer all the package options you need.

Speeding you from design to silicon is critical, and our easy-to-use MAX+PLUS II software helps meet your time-to-market deadlines. MAX+PLUS II is available for PCs and workstations, is compatible with industry standard CAE tools, and supports Verilog and VHDL interfaces. Its architecture independent design capability allows you to target your design into any Altera device family, including our revolutionary high-density FLEX devices.

For more information on MAX 7000, or to receive your copy of the Altera 1994 Data Book, call us now at 800-9-ALTERA (800-925-8372), 2610 Orchard Parkway, San Jose, CA 95134-2020.

We'll show you how to get a jump on the competition.

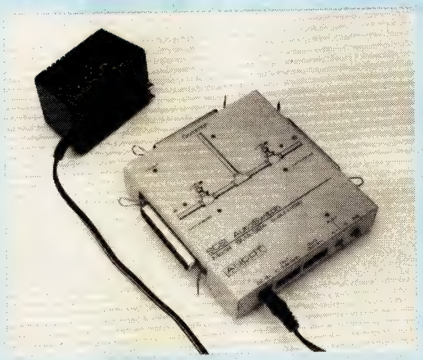
Package options: Plastic J-Leaded Chip Carrier (PLCC), Pin Grid Array (PGA), Quad Flat Pack (QFP) and our new 1-mm thick, Thin Quad Flat Pack (TQFP).

CIRCLE 351 FOR U.S. RESPONSE

CIRCLE 352 FOR RESPONSE OUTSIDE THE U.S.

SCSI SWITCH LINKS HOSTS TO PERIPHERALS

Model SMA-924 SCSI switch allows two host systems equipped with a SCSI interface to share the same SCSI peripherals. The switch automatically provides the proper connection upon demand from the host. For use with the 8-bit SCSI single-ended interface, the switch accommodates synchronous or asynchronous data transfers, and is compatible with SCSI-1, -2, and -2 Fast. A disconnected SCSI branch can be terminated with a built-in active terminator. LEDs on the switch housing indicate bus activity and termination status. A 6-V wall-mount power supply is included. The switch is available now for $795 each.



Ancot Corp., Menlo Park, Calif.;(415)322-5322. **CIRCLE 491**

■ *Booth 7358*

approach to insurance-risk assessment. The paper compares the results of tests using the traditional technique and fuzzy logic. In addition, a fuzzy-logic hardware application for character recognition is the subject of a paper from VLSI Technology, San Jose, Calif. The author proposes a system architecture using new hardware components to overcome the performance drawbacks of prior software approaches.

A novel technology, dubbed NeuFuz, combines the best features of neural networks and fuzzy logic into a hybrid that eliminates the shortcomings of each. Described in a paper from National Semiconductor Corp., the author also reviews the positives and negatives of fuzzy and neural-network technologies, and discusses potential NeuFuz application areas that range from appliances to industrial processing and control to automotive systems. Also included is a sample application problem for toaster control.

MACHINE VISION

Robotics is playing an increasingly vital role in equipment manufacture and assembly. Machine vision is one particularly critical element in such systems. In Session 2, several experts from a variety of industries discuss design and application of robotics and vision systems. A paper from the Dept. of Manufacturing Engineering at Miami University, Oxford, Ohio, reports on the latest robotics and vision-systems technologies for manufacturing applications and gives examples of actual implementations. The discussion covers machine-vision components, sensors, artificial intelligence, and expert systems. EG&G Reticon, Sunnyvale, Calif., then describes hardware solutions for increasing imaging speed and reducing costs in machine-vision systems.

The fundamentals of lighting for machine vision are presented by LumeX Co., Mogadore, Ohio. The discussion includes front, back, and structured lighting techniques, with emphasis on the spectral characteristics of various types of light sources. Omni Dimensional Networks, San Francisco, Calif., concludes this session by discussing how autosophy networks can be implemented to build a self-learning vision system for robots.

Session 6 looks at design and application aspects of machine vision, with special emphasis on image-processing techniques. Following an overview on vision systems by Miami University, a paper from CR Technology Inc., Laguna Hills, Calif., discusses real-time inspection and quality control. In addition, the advantages of digital-output cameras in image-processing applications will

HIGH WATTAGE COMES IN SMALL PACKAGES

The HD-PAK Series of dc-dc converters comes in a 4.6-by-2.4-by-0.5-in. package and provides 300 W at 54 W/in.^{3} A 48-V dc input family is for telecommunications applications, and a 300-V dc input version is for use in electronic data-processing and test equipment. The HD-PAK Series is priced at $260 each in quantities of 100. The 82 W/in.^{3} PJ-PAK Series of military dc-dc converters comes in a 2-by-4.25-by-0.5-in^3 package and is available with 28-V dc and 155-V dc inputs for $610 each in quantities of 100. A triple-output design, the Triple-Pak Series, provides a 150-W output at 19 W/in^3 for quasi-military applications. With a 28-V input, this version is priced at $943 in 100-piece quantities. Micro-Series of military converters are available with 28- and 155-V dc inputs and have 15- to 25-W outputs for $274 each in quantities of 100.

Powercube Corp., Billerica, Mass., (508) 667-9500.

CIRCLE 492

■ *Booths 3059, 3057*

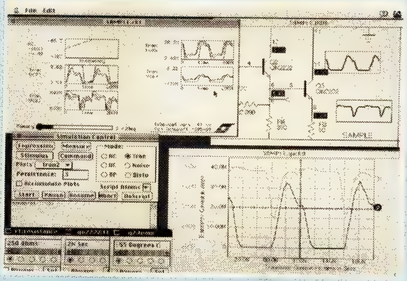
be presented by Cohu Inc., San Diego, Calif.

Image-processing functions involving repetitive computations can benefit from parallel processing, particularly for near-real-time applications. MetaBasics Inc., Pleasanton, Calif., describes the Pipelined Image-Processing Engine (PIPE) used for image and vision processing. The author tackles issues involving hardware architecture and the software environment.

Recent developments in image acquisition for manufacturing applications is the subject of a paper from Loral Fairchild Imaging Sensors, Milpitas, Calif. The presentation emphasizes post-acquisition electronic-image storage and information extraction. The Institute of Machine Tools and Production Science, Karlsruhe, Germany, rounds out this session by describing a milling operation that combines optical sensors, vision systems, and neural networks to measure tool wear.

CAE PACKAGE DESIGNS, ANALYZES CIRCUITS

The ICAP/4NT and ICAP/4Macintosh CAE software running on PC or Macintosh platforms integrate schematic entry, the interactive IsSpice4 simulator, model libraries, and graphical waveform analysis. Designers can simulate analog or mixed-signal circuit, including rf, power, ASIC, and filter designs. The model library contains over 5000 devices. Modeling options include an rf-device library, vendor-supplied models, and the SpiceMod program that makes models from vendor data sheets. The ICAP system accepts Spice netlists from schematic vendors. However, SpiceNet drives the entire simulation process from the schematic, including graphical circuit editing, Spice netlist generation, simulation control, circuit measurement, and waveform display. Prices start at $2595.



***Intusoft**, San Pedro, Calif.; (310) 833-0710.* **CIRCLE 493**
■ *Booth 2745*

DATA COMPRESSION

Data-compression technology has become indispensable for any system involving the transport and storage of huge amounts of data. Software packages can now double disk-drive capacity, while new standards can double modem transmission rates. Four speakers in Session 7 address advanced applications for lossless data compression.

The evolution of lossless data compression is traced in a paper by Omni Dimensional Networks, San Francisco, Calif. The author discusses various compression coding techniques, applications, and future directions. He concludes that data compression may be only the first sign of a coming revolution that will bring forth a new information theory as well as self-learning networks. A second paper from Omni discusses data compression for disk files and communications networks.

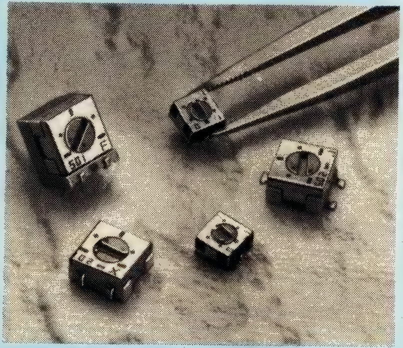
Employing autosophy networks in lossless image compression is the subject of a presentation by Applied Autosophy, Reseda, Calif. The paper imparts a new theory of learning and information, and compression techniques for HDTV and computer graphics.

Self-growing autosophy data networks may soon be used to design brain-like multimedia databases in which data is stored in a highly compressed format. This issue is addressed in a paper by Hughes Aircraft Co., Los Angeles, Calif. Included is a background discussion on autosophy and a description of an experimental learning system that exhibits a 3.7:1 data compression for a 522-kbyte database, and a 23:1 incremental data compression.

The topic of data compression spills over into Session 27 on digital video. First, an overview on digital video systems is given by Cahners Publishing Co., Newton, Mass.

TINY TRIMMING POTS ARE SURFACE-MOUNTABLE

Series G3 and G4 surface-mount trimming potentiometers are available in top-adjust versions, and the G4 series is also available in a side-adjust configuration. Terminal options are J-hook and gullwing. The G3 types are 3.4-by-3.2 mm and 2-mm high, and have a resistance range of 100 Ω to 1 MΩ. Power rating is 0.125 W. The G4 types are 5-by-4.5 mm and 2.8-mm high. The resistance range is 10 Ω to 2 MΩ, and the power rating is 0.25 W. Both series operate in temperatures from –55 C to 125 C and are sealed for solder-immersion cleaning processes per MIL-R-22097.



In quantities of 1000, the G3 costs $1.55 each and the G4 is $0.71 each. Delivery is in six to eight weeks.

***Tocos America**, Schaumburg, Ill.; (708) 884-6664.* **CIRCLE 494**
■ *Booth 6548*

If You Think High Performance FPGAs Cost Too Much...

A PREP COMPANY™

Presentations use or include the most recent PREP PLD Benchmark data
which was measured according to Benchmark Suite #1, Version 1.2, dated 3/28/93.
Any analysis is **not endorsed by PREP.**

Think Again. Think Actel. High Performance FPGAs Without The High Price.

Get a load of this...

Actel's A1240A devices can save you 50% over other leading FPGAs and EPROM-based PLDs at equivalent densities and performance. With millions of parts shipped, it is little wonder that Actel's popularity has helped us reduce our prices to a third of what they were only two years ago. That means, you can get the high performance you need at a price you can afford.

Think Performance and Predictability

Based on the 1993 PREP benchmarks, Actel's ACT 2 devices offer an exceptional price/performance value. For example, there's the A1240A-2, the fastest ACT 2 family member. It can implement a 16-bit accumulator at 36 MHz, a 16-bit counter at 58 MHz, and a 16-bit pre-scaled counter at 95 MHz.

ACT 2 is not only fast, but predictably fast, with no more than 10% variance from fastest to slowest instance according to the PREP benchmarks. Actel's segmented interconnect architecture and PLICE® antifuse technology deliver performance you can count on.

Actel	Actel	Xilinx	Altera
A1240A	A1240A-2	XC4005A-5	EPM7256-20
15.3	15.3	15.4	14.7
36.3 MHz	48.4 MHz	35.0 MHz	45.3 MHz
$68.80	$96.30	$138.70	$214.25

e/performance at 4000 gates – Actel's A1240A

Think Fast, Flexible Design

ACT 2 designs are easily captured with standard PLD tools like ABEL for state machine design or industry standard CAE tools from Mentor Graphics, Cadence, OrCAD and Viewlogic– to name a few. To complete your design, our Designer™ Series development tools start at $995 and feature fully automatic place and route with guaranteed high gate utilization.

Chart II	Actel	AMD
Device	A1225A	22V10Q-25
# Devices	1	12
Total Icc Power [4]	10 mA	660 mA
Total Price [5]	$42.50	$69.36

For integrating 2500 gates use one Actel FPGA or 12 22V10s

Think Service and Support

You get all this, plus extensive service and support. Actel's technical HOTLINE and our Action FACTS system provides you automatic access to technical documents, design tips and experienced engineering support to help you meet your time to market goals.

So for high performance at a price you can afford – Think Actel. For more information, call us at **1-800-228-3532** or send in the attached card today. You'll receive our new 1994 full line databook and you can request your own copy of the 1993 PREP benchmarks. Also ask us about our 1200 gate FPGAs for under $10!

Please call 1-800-228-3532

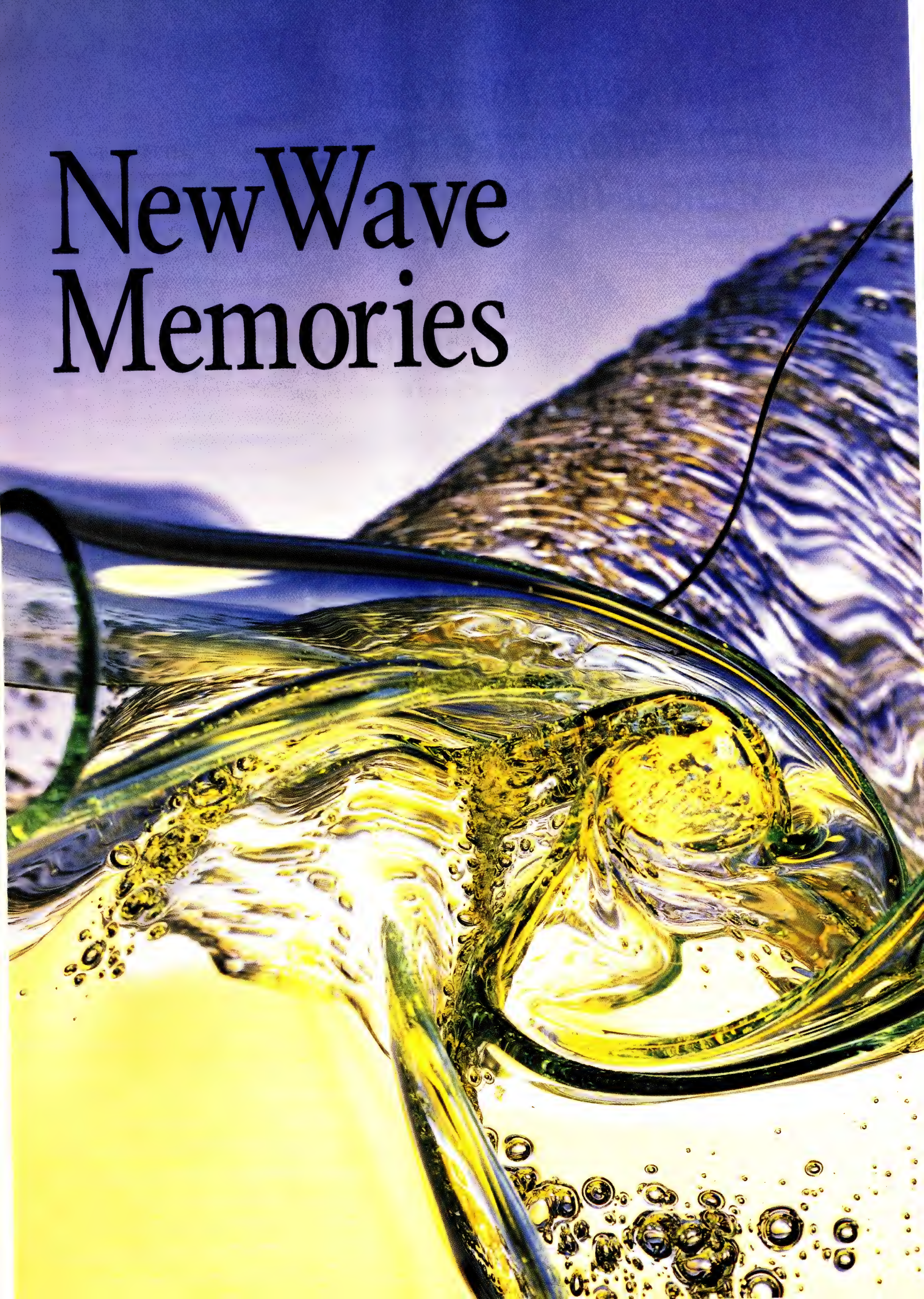
Actel

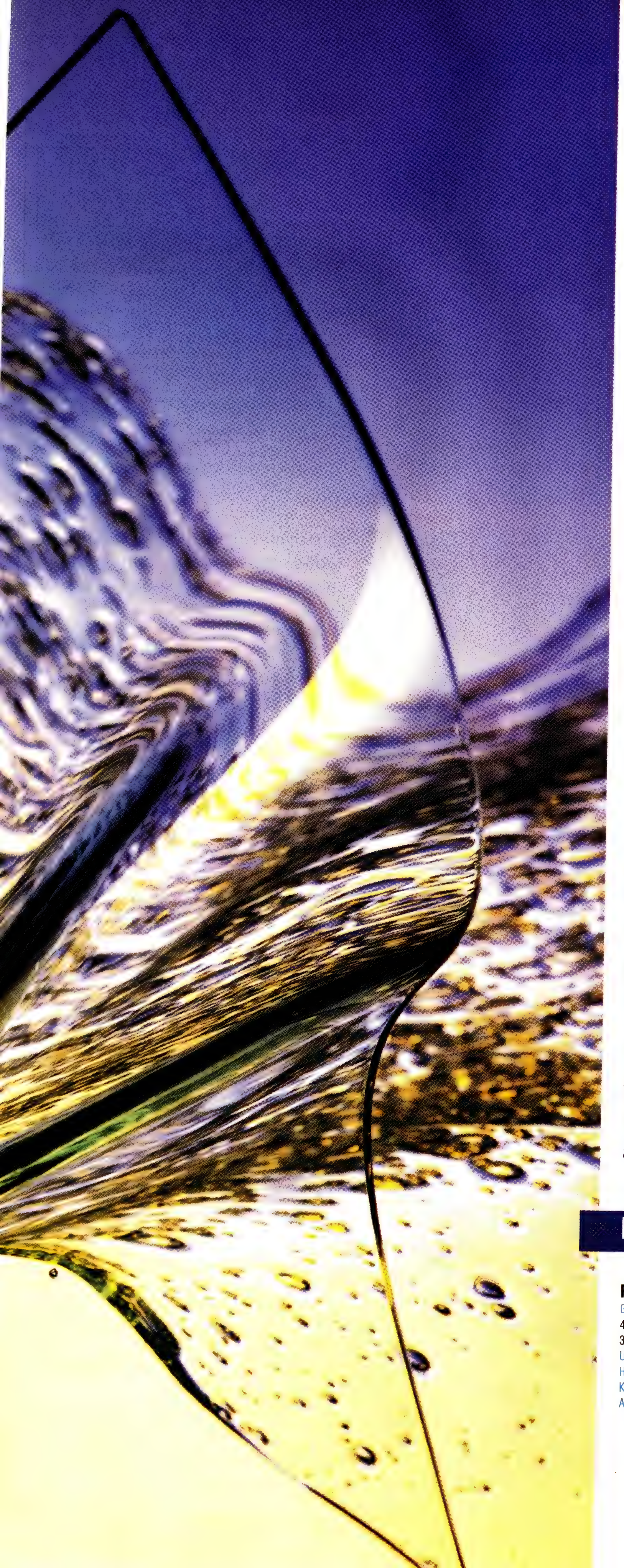
Actel Corporation 955 E. Arques Avenue, Sunnyvale CA 94086 Actel Europe Ltd. Intec 2, Wade Road, Basingstoke, Hants RG24 ONE U.K.

1. Average number of PREP instances, approximately 4000 gates or 20 PALCE22V10s. 2. PREP Derived Data-average internal operating frequency, in MHz. 3. 100 piece PQFP price quoted by authorized distributor, August/September 1993. 4. Typical Icc per device multiplied by number of devices. 5. Based on 100 piece PLCC price quoted by authorized distributor, August/September 1993. ACT, PLICE, Designer, and the Actel logo are trademarks or registered trademarks of Actel Corporation. PREP is a trademark of the Programmable Electronics Performance Corporation. All other brand or product names are property of their respective holders.

CIRCLE 82 FOR U.S. RESPONSE **CIRCLE 83 FOR RESPONSE OUTSIDE THE U.S.**

New Wave Memories





New 4M video RAMs feature 60ns speed; 256K x 16 RAM and 512 x 16 SAM.

Video memories should release, not restrict, the flow of images. That's why the leader in 2M video RAMs is introducing a new generation of 4M VRAMs designed to give you faster graphics, higher resolution and an expanded color palette.

Dual port technology increases speed and convenience. NEC's new 4-Megabit video RAMs use a 0.5μ CMOS process to integrate a 256Kx16 RAM and a 512x16 SAM. Access speeds to both RAM and SAM are unsurpassed – 60ns and 15ns, respectively.

Convenient functions for the RAM port include Block Write, Flash Write, Byte Write Control, and Write per Bit.

The SAM port permits operation at speeds up to 50MHz. It features Split Read/Write Transfer and Binary Boundary Jump.

Our 4M VRAMs are available in two access modes: fast page and hyper page. The hyper page type runs at speeds up to 33MHz clock. Both types support 5V and 3.3V operation.

Graphics performance can give you a critical advantage in the today's market for workstations or high-end PCs. To enhance speed, resolution and color in your system, find out about the new 4M VRAMs from NEC.

From the leader in memory technology

For fast answers, call us at: USA Tel:1-800-366-9782. Fax:1-800-729-9288. Germany Tel:0211-650302. Fax:0211-6503490. The Netherlands Tel:040-445-845. Fax:040-444-580. Sweden Tel:08-753-6020. Fax:08-755-3506. France Tel:1-3067-5800. Fax:1-3946-3663. Spain Tel:1-504-2787. Fax:1-504-2860. Italy Tel:02-6709108. Fax:02-66981329. UK Tel:0908-691133. Fax:0908-670290. Ireland Tel:01-6794200. Fax:01-6794081. Hong Kong Tel:886-9318. Fax:886-9022. Taiwan Tel:02-719-2377. Fax:02-719-5951. Korea Tel:02-551-0450. Fax:02-551-0451. Singapore Tel:253-8311. Fax:250-3583. Australia Tel:03-8878012. Fax:03-8878014. Japan Tel:03-3454-1111. Fax:03-3798-6059.

CIRCLE 170 FOR U.S. RESPONSE
CIRCLE 171 FOR RESPONSE OUTSIDE THE U.S.

NEC

MINIATURE KEYBOARD FITS PORTABLES

Measuring 217-by-76-by-9.7 mm and weighing 80 grams, the FKB1406 keyboard is based on membrane technology for use in portable devices. The keyboard offers 64- to 101-key functionality, has 15-mm key spacing, and a 1.5-mm keystroke. Operating in 0° to 40° C temperatures, the keyboard has a minimum operational life of 2 million keystrokes. The board can be configured as a semicustom model for special requirements such as colors and legends. English, U.K., French, German, Italian, and Swedish versions are also available. Pricing is under $30 each in OEM quantities.

***Fujitsu Microelectronics, Inc.**, San Jose, Calif.; (408) 922-9000.* **CIRCLE 495**

■ *Booth 6456*

Then, Brooktree Corp., San Diego, Calif., discusses digital-video decoding techniques and traditional decoding systems. The company also introduces its all-digital decoder chip. Image preprocessing for optimal compression is addressed by Philips Semiconductors, Sunnyvale, Calif. The author reviews TV broadcast standards, compression input formats, video-capturing methods, and resizing techniques.

Pixel Semiconductor Inc., Plano, Texas, identifies the challenges of merging video into a graphics display in multimedia applications, and then offers solutions. The subjects covered include overcoming the conflicting video standards for image scaling; color-format conversion; compression/decompression algorithms; and the advantages and disadvantages of analog, digital, and hybrid design solutions. The session ends with a look at the issues concerning audio for digital video by Texas Instruments, Dallas.

EMBEDDED PCs

Using the IBM PC/AT architecture in non-desktop, embedded applications continues to pique the interest of designers of communications devices, vending machines, test equipment, data-acquisition and control products, and medical instruments. Session 28 reviews advantages, disadvantages, and enhancements to the PC architecture, and compares alternative implementations.

The session opens with a presentation from Ampro Computers Inc., Sunnyvale Calif., which discusses the need for embedded-system standards, PC hardware and software options, the shortcomings of standard PCs, mechanical and environmental concerns, and functional enhancements for embedded applications. The author also reviews PC repackaging schemes for embedded systems. This is followed up I-Bus Systems' (San Diego, Calif.) look at passive-backplane PCs for embedded applications.

Pro-Log Corp., Monterey, Calif., provides a checklist that runs down the common requirements for an embedded PC. The paper elaborates on

ROCKER SWITCHES NEED NO ILLUMINATION

Panel switches with 2-color rocker actuators have high on-off position visibility sans lighted legends. Hi-Lite Rockers are UL recognized, CSA certified, and VDE approved. They have inrush-current capacities of up to 110 A at 125 V ac and come rated up to 22 A at 125 V ac, 16 A at 250 V ac. Many colors are available along with special markings and legends. Mounting options are solder lug and quick-connect terminals.

***Eaton Corp.**, Milwaukee, Wis.; (414) 449-7483.* **CIRCLE 496**

■ *Booths 6636, 6638, 6640*

MINIATURE FAN COOLS SELECTED COMPONENTS

A 40-by-15-mm fan provides spot cooling for MPUs and other board-mounted devices that generate heat. Operating on 12 V dc, the fan provides up to 8 cfm of free-air performance and weighs only 20 gm. The ball-bearing type design promotes quiet operation and long life.

The miniature fans are available for $11 each in OEM quantities and are also covered by a five-year warranty.

***NMB Technologies, Inc.**, Chatsworth, Calif.; (818) 341-3355.* **CIRCLE 497**

■ *Booth 1337*

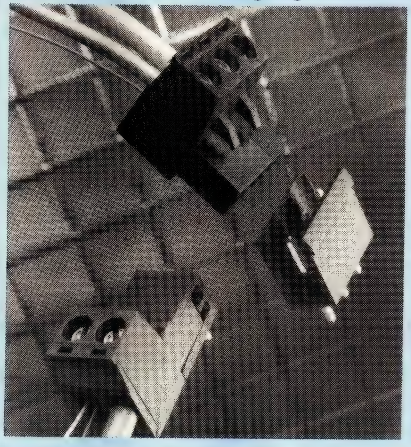
the specifics of the checklist items, including mechanical ruggedness, open architecture, I/O, connectivity, packaging, and operator interface. The PC-compatible, busless single-board computer approach is given its due by Megatel Computer Corp, Weston, Ontario, Canada. Following an overview and history of embedded PCs, the hardware and software features of a busless single-board computer are detailed.

A second Ampro paper winds up the session by discussing the use of PC/104 embedded PC modules. The author describes a proposed extension to the IEEE-P996 specification for the PC/104 form factor. Also covered are bus-configuration options, signal definitions, and electrical characteristics.☐

HOW VALUABLE?	CIRCLE
HIGHLY	481
MODERATELY	482
SLIGHTLY	483

TERMINAL BLOCKS PLUG INTO CIRCUIT BOARDS

Eurostyle terminal blocks are a two-piece plug and header system that are polarized with the industry-standard scalloped design. The plug features rising cage pressure clamps for holding wire sizes between 12 and 30 AWG.



Two types are available, differing only in their terminal spacing: Series 86 has terminals spaced on 0.200-in. centers, and Series 87 is on 5.0-mm (0.197-in.) centers. Both terminal blocks are available in lengths from 2 to 12 circuits. The pricing is $0.44 per mateable set in quantities of 250 pieces.

The terminal blocks can be delivered from the factory in three weeks after receipt of order. They are also available immediately from stocking distributors.

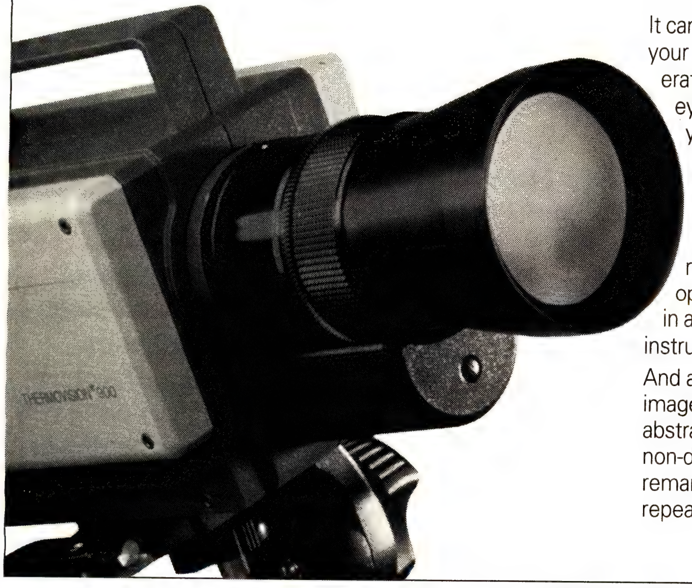
Beau Interconnect Systems,
Laconia, N.H.; (603) 524-5102.

CIRCLE 498

■ *Booth 6317*

Sixth Sensor.

A Thermovision® infrared imaging system lets you see beyond the obvious.



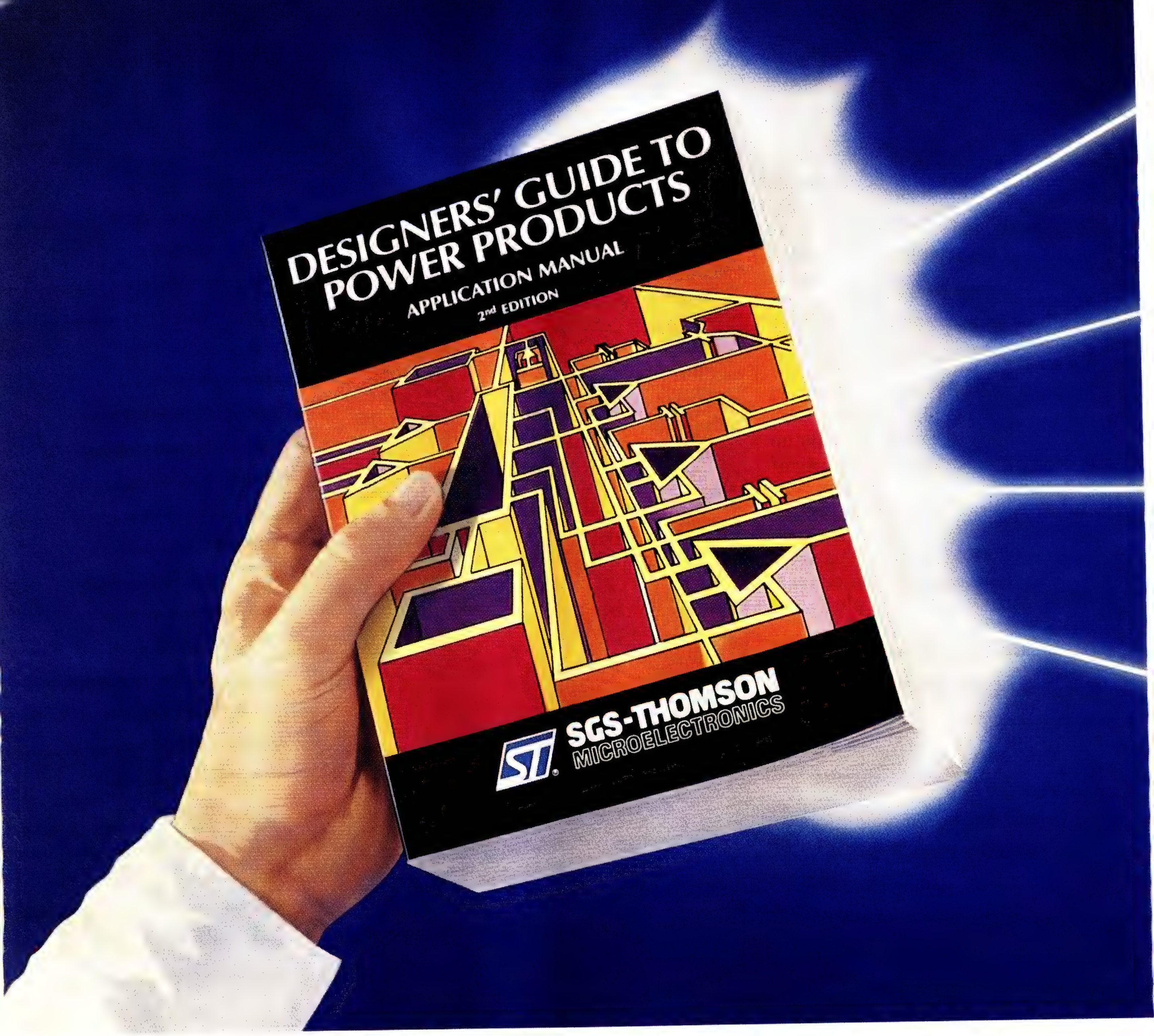
It can tell you a lot more about your product than just its temperature. It can also open your eyes to hidden aspects of your product's synergism and performance, and confirm theoretical computer models under real or simulated operating conditions in a way that no other instrument can.

And a Thermovision infrared imager can help you bring the abstract into reality in real time, non-destructively and with remarkable accuracy and repeatability.

For "Benchmarkers", a comprehensive multi-media kit that will show you how you can use the infrared imagers that set the standards for non-contact temperature measurement to set the standards for your product, check the reader service number or call or write AGEMA Infrared Systems Inc.,
550 County Avenue,
Secaucus, NJ 07094.
201-867-5390.
Fax. 201-867-2191.

AGEMA
Infrared Systems

CIRCLE 84 FOR U.S. RESPONSE
CIRCLE 85 FOR RESPONSE OUTSIDE THE U.S.



NOW THE POWER CAN BE

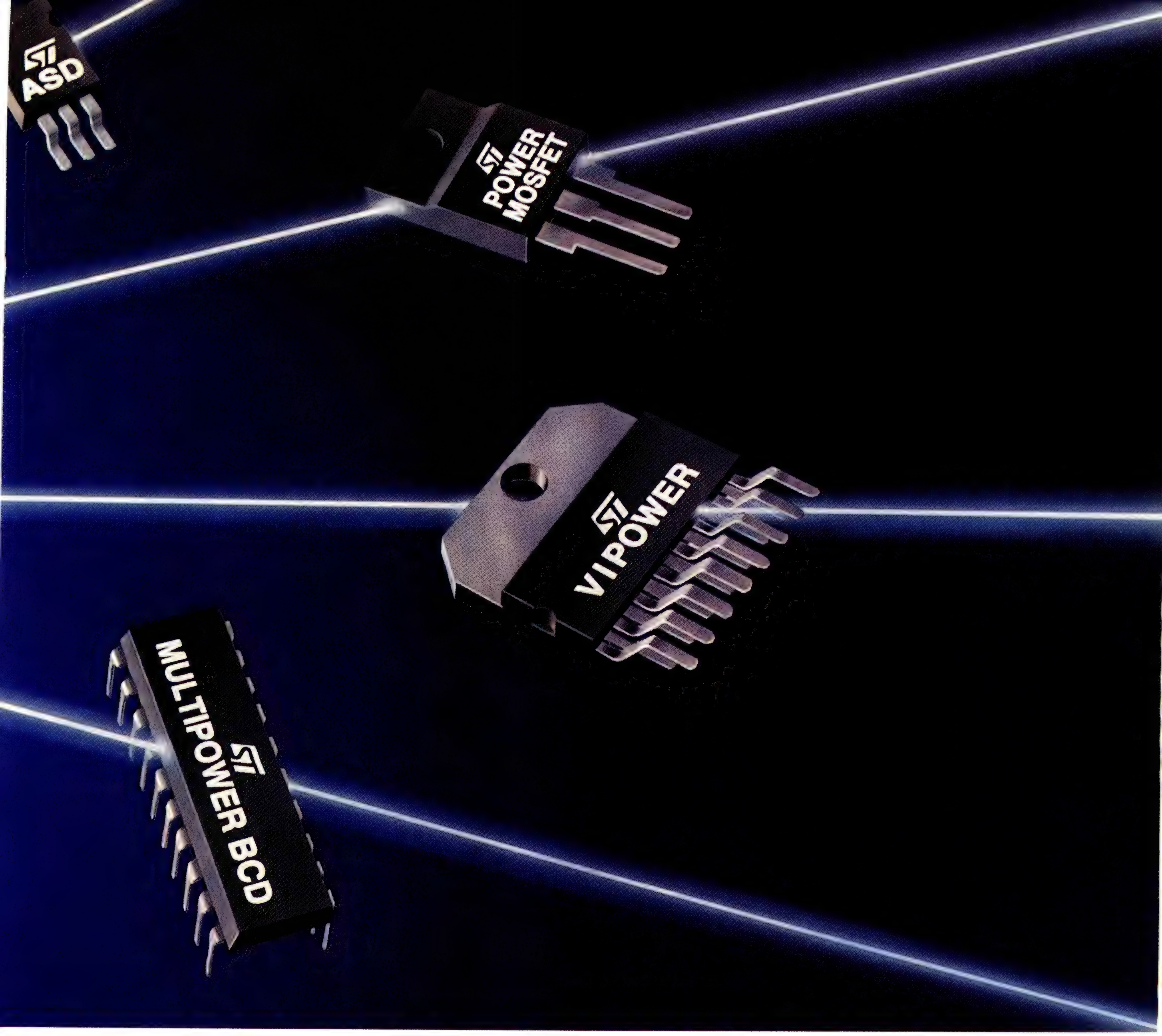
SGS-THOMSON, the world leader in Smart Power ICs, can put an encyclopedia of dynamic power applications, plus the industry's most innovative power ICs and discretes in your hands.

Want to minimize assembly costs and maximize reliability? Increase design functionality and performance without increasing complexity and costs? Deliver more power to the load without expensive heatsinks and cooling fans?

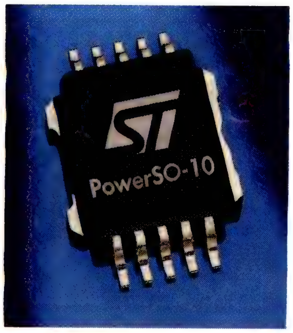
Send for SGS-THOMSON Microelectronics Free *Designer's Guide to Power Products.* You'll find the most efficient solutions to tough power design problems right at your fingertips. The *Designer's Guide* is the one reference source that gives you ready answers to questions about stepper, DC and brushless motor control, plus power supplies, thermal management and more.

As the world's number one supplier of power ICs, SGS-THOMSON can support you with much more than an encyclopedia of powerful ideas. We back your designs with leading power products. For example, Multipower-BCD™ (Bipolar, CMOS and DMOS), the world's leading Smart Power technology, lets you integrate

© 1993 SGS-THOMSON Microelectronics. All rights reserved.



N YOUR HANDS. FREE.



The leader in power packages comes through again with PowerSO-10™, the first in a new *series of high thermal performance* surface mount packages.

unlimited power transistors in the output stages. Our unique VIPower™ devices feature true vertical current flow just like a power transistor, with your choice of MOS or Bipolar output. SGS-THOMSON's extensive family of Power MOS transistors are lowering dissipation and raising device speeds.

Mail us your business card or write us on your company letterhead today: 1000 E. Bell Road, Phoenix, Arizona 85022. Or FAX 602-867-6102. If you are a design engineer, SGS-THOMSON will put real power in your hands with a free copy of our 1200-page *Designer's Guide to Power Products* (while supplies last). Once you've seen how good our power design ideas look on paper, you'll want to see them in silicon.

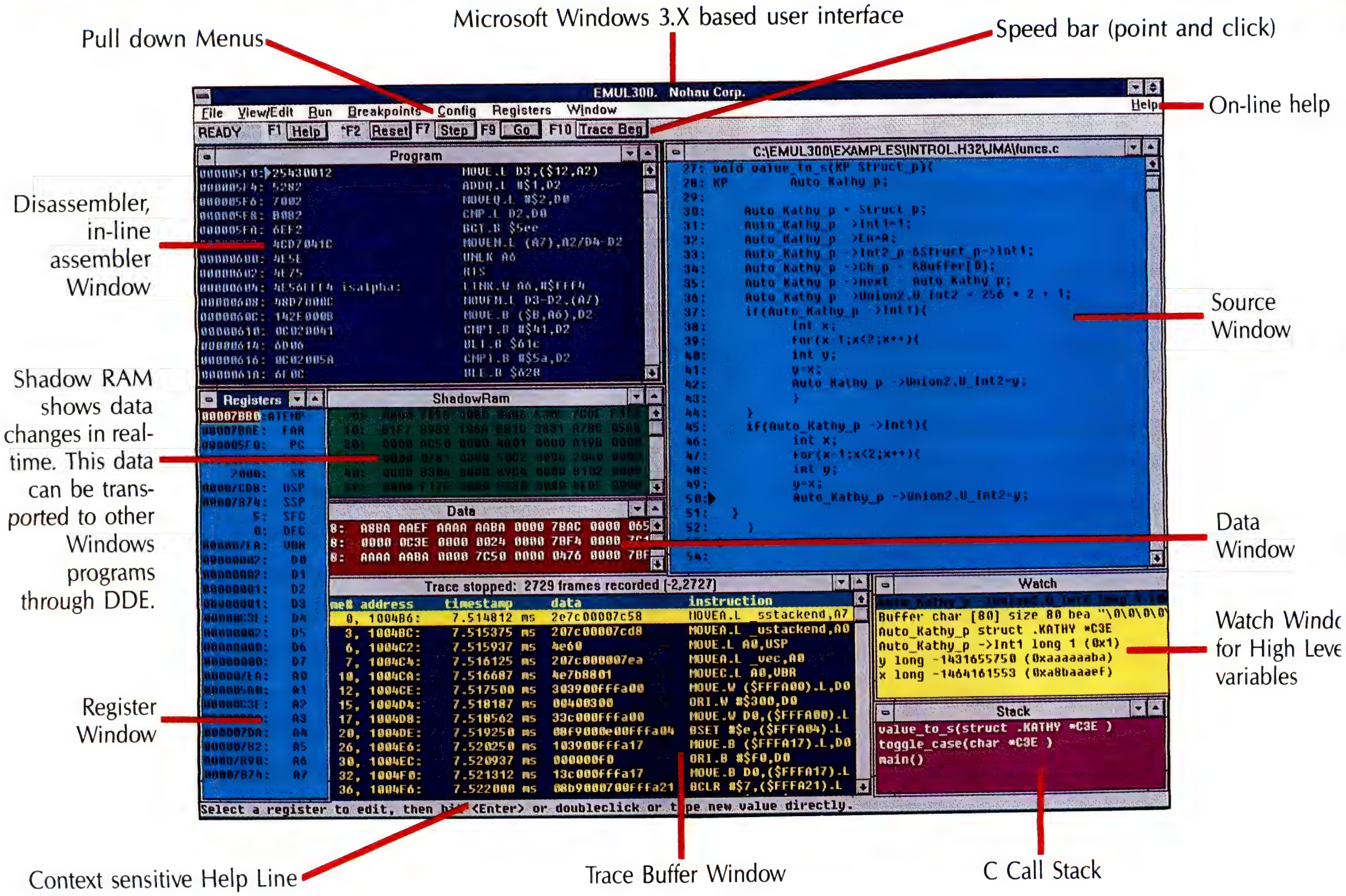
SGS-THOMSON
MICROELECTRONICS

CIRCLE 202 FOR U.S. RESPONSE

CIRCLE 203 FOR RESPONSE OUTSIDE THE U.S.

In-Circuit Emulators and Background Debuggers

68300 68HC16


Pull down Menus
Microsoft Windows 3.X based user interface
Speed bar (point and click)
On-line help
Disassembler, in-line assembler Window
Source Window
Shadow RAM shows data changes in real-time. This data can be transported to other Windows programs through DDE.
Data Window
Watch Window for High Level variables
Register Window
Context sensitive Help Line
Trace Buffer Window
C Call Stack
EMUL300. Nohau Corp.
File
View/Edit
Run
Breakpoints
Config
Registers
Window
Help
READY
F1 Help
*F2 Reset
F7 Step
F9 Go
F10 Trace Beg
Program
Registers
ShadowRam
Data
Watch
Stack
C:\EMUL300\EXAMPLES\INTROL.H32\JMA\funcs.c

```
000005F0: 25430012           MOVE.L D3,($12,A2)
000005F4: 5282               ADDQ.L #$1,D2
000005F6: 7002               MOVEQ.L #$2,D0
000005F8: B082               CMP.L D2,D0
000005FA: 6EF2               BGT.B $5ee
          4CD7041C           MOVEM.L (A7),A2/D4-D2
00000600: 4E5E               UNLK A6
00000602: 4E75               RTS
00000604: 4E56FFF4 isalpha:  LINK.W A6,#$FFF4
00000608: 48D7000C           MOVEM.L D3-D2,(A7)
0000060C: 142E000B           MOVE.B ($B,A6),D2
00000610: 0C020041           CMPI.B #$41,D2
00000614: 6D06               BLT.B $61c
00000616: 0C02005A           CMPI.B #$5a,D2
0000061A: 6F0C               BLE.B $628
```

```
void value_to_s(KP Struct_p){
KP          Auto_Kathy_p;

     Auto_Kathy_p = Struct_p;
     Auto_Kathy_p ->Int1=1;
     Auto_Kathy_p ->En=A;
     Auto_Kathy_p ->Int2_p=&Struct_p->Int1;
     Auto_Kathy_p ->Ch_p = &Buffer[0];
     Auto_Kathy_p ->next = Auto_Kathy_p;
     Auto_Kathy_p ->Union2.U_Int2 = 256 * 2 + 1;
     if(Auto_Kathy_p ->Int1){
          int x;
          for(x=1;x<2;x++){
          int y;
          y=x;
          Auto_Kathy_p ->Union2.U_Int2=y;
          }
     }
     if(Auto_Kathy_p ->Int1){
          int x;
          for(x=1;x<2;x++){
          int y;
          y=x;
          Auto_Kathy_p ->Union2.U_Int2=y;
   }
     }
```

```
8:  A8BA AAEF AAAA AABA 0000 7BAC 0000 065
8:  0000 0C3E 0000 0024 0000 7BF4 0000
8:  AAAA AABA 0008 7C50 0000 0476 0000 7BF
```

```
Trace stopped: 2729 frames recorded [-2,2727]
me# address  timestamp    data               instruction
 0, 1004B6:  7.514812 ms  2e7c00007c58       MOVEA.L  _sstackend,A7
 3, 1004BC:  7.515375 ms  207c00007cd8       MOVEA.L  _ustackend,A0
 6, 1004C2:  7.515937 ms  4e60               MOVE.L A0,USP
 7, 1004C4:  7.516125 ms  207c000007ea       MOVEA.L  _vec,A0
10, 1004CA:  7.516687 ms  4e7b8801           MOVEC.L A0,VBR
12, 1004CE:  7.517500 ms  303900FFFa00       MOVE.W ($FFFA00).L,D0
15, 1004D4:  7.518187 ms  00400300           ORI.W #$300,D0
17, 1004D8:  7.518562 ms  33c000FFFa00       MOVE.W D0,($FFFA00).L
20, 1004DE:  7.519250 ms  08F9000e00FFFa04   BSET #$e,($FFFA04).L
26, 1004E6:  7.520250 ms  103900FFFa17       MOVE.B ($FFFA17).L,D0
30, 1004EC:  7.520937 ms  000000F0           ORI.B #$F0,D0
32, 1004F0:  7.521312 ms  13c000FFFa17       MOVE.B D0,($FFFA17).L
36, 1004F6:  7.522000 ms  08b9000700FFFa21   BCLR #$7,($FFFA21).L
```

```
Buffer char [80] size 80 bea "\0\0\0\0
Auto_Kathy_p struct .KATHY *C3E
Auto_Kathy_p ->Int1 long 1 (0x1)
y long -1431655750 (0xaaaaaaba)
x long -1464161553 (0xa8baaaef)
```

```
value_to_s(struct .KATHY *C3E )
toggle_case(char *C3E )
main()
```

```
Select a register to edit, then hit <Enter> or doubleclick or type new value directly.
```

FEATURES

- Supports both the 683xx and 68HC16 families.
- User Interface under Microsoft Windows.
- Modular approach: From low cost to full feature.
- Real-time emulation at maximum chip speed.
- High-Level C support with in-depth support for Intermetrics, Introl, Microtec, Sierra and more. In-line assembler and disassembler.
- Hardware and software breakpoints.
- Up to 4 Mbytes of emulation RAM
- Trace board, up to 512k records deep, 104 bits wide, 40 bit timestamp.
- Triggering and filtering, with full pipeline decoding.
- Code Coverage. Program Performance Analysis.
- Memory Contents available in real-time (Shadow RAM).
- DDE support to transfer Shadow Ram to other Windows applications.

8051 68HC11

Full support for all derivatives.
Call for FREE demo disk.

To learn more, *please call (408) 866-1820 for a FREE Demo Disk. Or call our 24-hour Information Center at (408) 378-2912 for information via your fax.*

NOHAU CORPORATION

51 E. Campbell Avenue
Campbell, CA 95008
Tel (408) 866-1820
Fax (408) 378-7869

Australia (02) 654 1873, Austria 0277 20-0, Benelux (01858) 16133, Brazil (011)-458-8755, Canada 1-514 689-5889, Czechoslovakia 0202-2683, Denmark 43 44 60 10, Finland 90-4526-21, France (1) 69 41 28 01, Germany 08131-25083, Great Britain 0962-733140, Greece (01) 862 9901, Hungary (1) 163 7461, India (0212) 422164, Israel (03) 491202, Italy (011) 771 00 10, Korea (032) 860-5470, New Zealand 09-3092464, Norway 02-67 40 20, Portugal 01-80 95 18, Romania 961-30078, Singapore +65 749-0870, Slovenia 061-445-526, S. Africa (021) 23-4943, Spain (93) 217 23 40, Sweden 040-92 24 25, Switzerland 01-740 41 05, Taiwan 02 7640215, Thailand (02) 281-9596.

CIRCLE 295 FOR U.S. RESPONSE

CIRCLE 296 FOR RESPONSE OUTSIDE THE U.S.

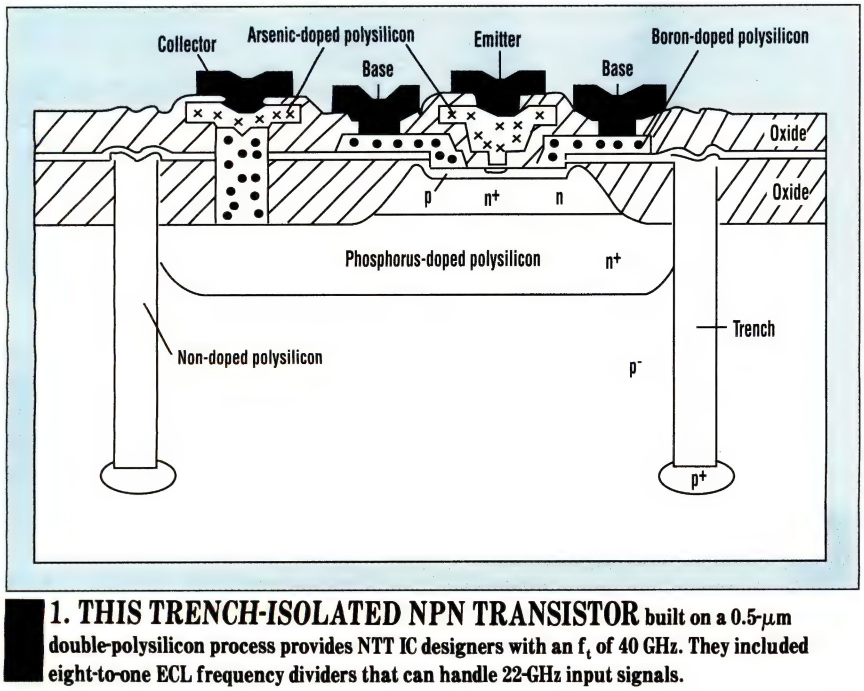
RECENT ADVANCES STRETCH BIPOLAR/BICMOS PROCESSES

1993 BIPOLAR/BICMOS CIRCUITS AND TECHNOLOGY MEETING AIRS ADVANCED ANALOG/DIGITAL PROCESSES AND ICS.

FRANK GOODENOUGH

Despite the continual advances in CMOS technology, bipolar junction transistors (BJTs) will always be needed for most of the tough tasks, particularly those demanding maximum speed or bandwidth. Though they may not receive the hype given some of the other technology breakthroughs, BJTs and other bipolar technologies are just as important in attaining high performance. The primary venue for announcements of major advances in bipolar technology is the Bipolar/BiCMOS Circuits and Technology Meeting. The conference is held every year in Minneapolis.

This year's conference (October 4 and 5) is dominated by technical presentations describing high-speed npn-only processes and circuits for next-generation logic. Others touch on topics ranging from trench-isolated transistor structures for both digital and analog circuits to RF and high-voltage/power ICs. In addition, several papers describe npn transistors with an f_t between 30 and 40 GHz, performance that challenges GaAs MESFETs.



1. THIS TRENCH-ISOLATED NPN TRANSISTOR built on a 0.5-µm double-polysilicon process provides NTT IC designers with an f_t of 40 GHz. They included eight-to-one ECL frequency dividers that can handle 22-GHz input signals.

The show is highlighted by trench-isolated npn-only processes developed by three companies: NTT's LSI Laboratory, Atsigi-shi, Japan; Hitachi's Central Research Laboratory, Tokyo, Japan; and Tektronix Microelectronics Inc., Beaverton Ore. (described in Sessions 4.2, 4.3, and 14.1, respectively). Their npn transistors achieved f_ts of 40 GHz, 38 GHz, and 30 GHz, respectively. A fourth paper (Session 14.1), from IBM, Yorktown Heights N.Y., describes a complementary ECL circuit built on a complementary-bipolar (CB) process that can be used to produce 35-GHz pnp transistors.

The NTT team calls its process the Super Self-aligned, 0.5-µm double-polysilicon process, or SST1C *(Fig. 1)*. To create the shallow base required to build fast-switching vertical npn transistors, the process uses a thin oxide that's been implanted with BF_2 (boron difluoride), which is used as a diffusion source. The technique minimizes channeling, damage to the crystal structure, and base resistance. Damage is further reduced by rapid thermal annealing (RTA) of the base structure after implantation and diffusion.

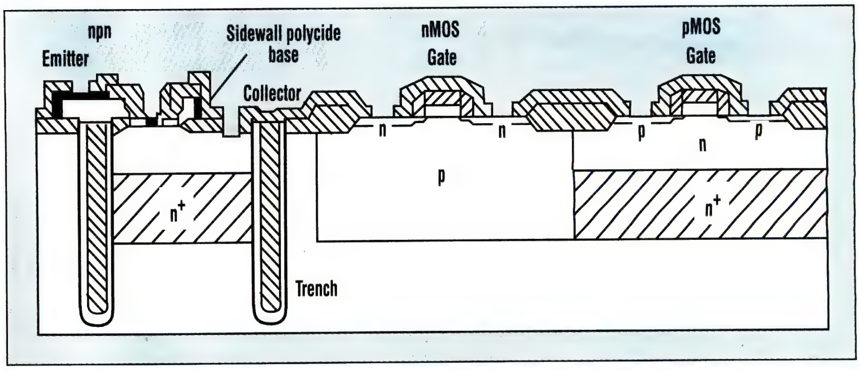
The collector electrode is formed by filling the trench with phosphorous-doped polysilicon, which reduces device area and collector resistance. The 40-GHz f_t was achieved at a collector-emitter voltage of 1 V and a collector current of 1.2 mA. The transistor's BV_{CEO} is 3.6 V, its Early voltage (V_A) is 9.8 V, and its current gain (β) is 60, resulting in a βV_A product of about 600 V.

Because β is a dimensionless number and Early voltage is in volts, the units of their product is expressed basically in volts. However, Early voltage, which is a "figure-of-merit," is often expressed as a dimensionless number, as is βV_A.

TINY FEET

The second of the trench-isolated npn-only processes is Hitachi's biCMOS technique. Its designers pursued a dual goal in developing the process: maximize the f_t and minimize bipolar-transistor size *(Fig. 2)*. As a result, the process can be used to build very small silicon npn transistors with footprints of just 9.4 μm^2. It can also be used to build CMOS FETs with gate lengths between 0.4 and 0.6 μm. The npn transistors employ a sidewall polycide base technology called SPOTEC, which cuts the devices' size to less than that of CMOS FETs made with the same the process.

The npn transistor's 38-GHz f_t was achieved by low-energy base implantation followed by RTA and pedestal-collector implants. To minimize the npn transistor's isolation area, the narrow (0.6 μm), deep (3 μm) trench is etched close to the active region and filled with SiO_2 by chemical vapor deposition (CVD). The sidewall-polycide base technology, which self-aligns the polysilicon base to the intrinsic base region, further reduces the npn transistor's size. In this process, CVD is used to selectively deposits tungsten on the sidewall surfaces of the polysilicon, which is then silicided.



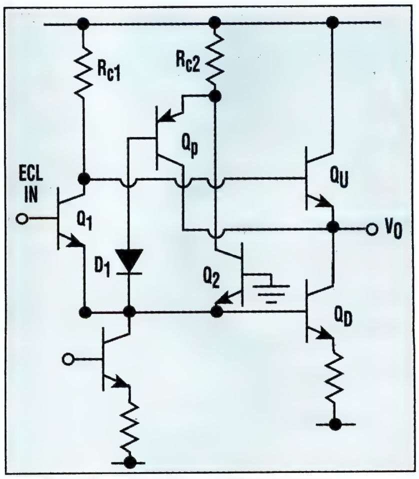
2. TRENCH ISOLATION **and a sidewall-polycide base process build the npn transistor in Hitachi's biCMOS process. The transistor provides an f_t of 38 GHz and is smaller than MOSFETs from the technology.**

CMOS and biCMOS gates with the same total area were built on the process. The delays for the biCMOS gates ran less than half that for the CMOS gates. When driving 0.5 pF, the delays were 0.4 and 1.1 ns, respectively.

WIDE SIGNAL SWINGS

The third process advance comes from Tektronix. Circuits built on its 30-GHz process must handle analog and mixed-signal circuits with signal swings potentially far greater than those required of ECL. Thus, two versions were developed with BV_{CEO}s of 4.5 and 7, respectively (a function of the thickness of the epitaxial layer).

The higher-voltage 7-V process version has a lower f_t of 22 GHz. Both process versions can be used to also build Schottky diodes and lateral pnp transistors. They can also be used to build laser-wafer-trimmable, thin-film NiCr resistors. As is the case with the two previous processes, the Tektronix technology employs a deep (4 μm), narrow (0.8 μm) trench and RTA.



3. THIS ECL CIRCUIT **developed by IBM is built on a complementary-bipolar process. The vertical pull-up pnp Q_p has an f_t of 35 GHz. It can cut gate power for a given gate delay while driving a given capacitive load.**

COMPLEMENTARY ECL

Until recently, high-speed CB processes have been the hallmark of state-of-the-art analog ICs (ELECTRONIC DESIGN, *Sept. 2, p. 47)*. However, IBM's Research Div., Yorktown Heights, N.Y., used a CB process with 0.8-μm design rules to build high-speed digital circuits. IBM employs a self-aligned, double-polysilicon technology to build a direct-coupled complementary push-pull ECL (DC-PP-ECL) monolithic circuit *(Fig. 3)*.

The high-speed circuit not only cuts the delay of a 1-mW gate in half and raises its drive capability by a factor of two, but it also reduces the gate power required for a given delay. It features a direct-coupled pnp pull-up transistor (Q_p) that's used with the conventional npn pull-down transistor (Q_d).

Applying pull-up, pull-down transistors provides a sharp, self-terminating, current pulse through the pull-up transistor during the switching transient. The circuit minimizes gate delay by completely decoupling the collector load resistor (R_c) from the signal path.

Gate delay for the circuit runs 158 ps/pF for the complementary ECL gates. In comparison, gate delay for conventional ECL gates manufac-

You don't always get what you pay for.

With PTS synthesizers, you get more.

Because we're synthesizer specialists, we give you *more for your money* in more ways than one.

From our economy PTS x10, to our space-saving PTS 310, to our top-of-the-line PTS 1000, we have *more models* to cover your source needs from 100 KHz to 1 GHz.

And more options, including:

- OCXO, TCXO or external standard,
- choice of resolution from 100 KHz to 0.1 Hz,
- DDS with phase-continuous switching,
- digital phase rotation,
- BCD or GPIB remote control,

and almost a hundred others to let you specify a synthesizer so well-tailored to your requirements that it's like having one custom made for you.

Our priority in design and manufacturing is to make our synthesizers *more reliable*, and this has led to a demonstrated MTBF of 25,000 hours. That's why we can back them with our all-inclusive 2-year warranty, along with a flat-rate service charge for eight years following the warranty period.

But wait, there's less!

All of our synthesizers feature *low* power consumption, *low* spurious output (as *low* as -75 dBc), *low* phase noise, and fast frequency switching (as fast as 1 μsecond).

And all of our models are available, at a lower price, in a remote-only OEM configuration for easy integration into your OEM system.

Our full catalog has all the information you need to specify the most synthesizer for your money.

Call or FAX us for your copy, or for immediate engineering assistance.

PTS

PROGRAMMED TEST SOURCES

P.O. Box 517 Littleton, MA 01460
508/486-3008 FAX 508/486-4495

CIRCLE 196 FOR U.S. RESPONSE CIRCLE 197 FOR RESPONSE OUTSIDE THE U.S.

tured on the same process run over twice that at 351 ps/pF.

Driving a 3-pF load, the delay for a 1-mW ECL gate on the CB process is a mere 100 ps. On the other hand, the delay nearly doubles for a 1-mW conventional ECL gate manufactured on the same process.

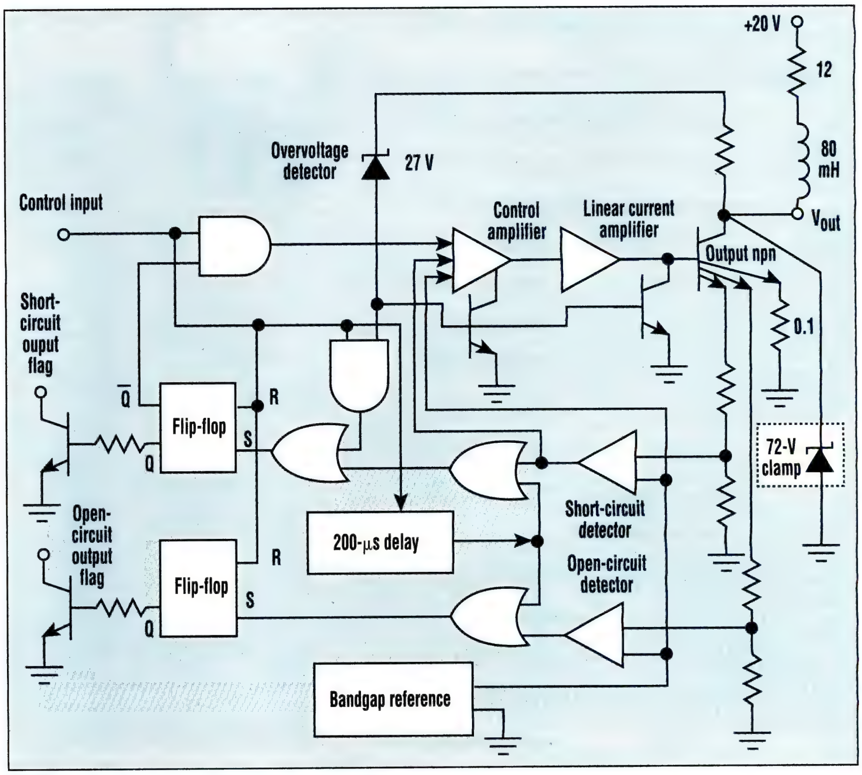
ISOLATED CB PROCESSES

A pair of technical presentations, one from Tektronix (Beaverton, Ore.) and one from United Technologies (Colorado Springs, Colo.), describe the latest analog CB processes (Sessions 8.2 and 3.2, respectively). Both processes use different forms of isolation.

The Tektronix process can be used to build JI npn transistors with an f_t of 9 GHz, and pnp transistors with an f_t of 5 GHz. The BV_{CEO} for the npn transistors is 9 V and for the pnp transistors 10 V.

Bipolar transistors for analog circuits demand more from the process than transistors used in ECL gates. Particularly, the βV_A product must be maximized. However, V_A is a function of BV_{CEO}, which usually drops in value with an increase in the f_t. As a result, when designing high-frequency analog processes, engineers must make trade-offs between the maximum f_t possible and the BV_{CEO} level needed to handle analog signals.

A good rule of thumb states that βV_A should equal 2^n, where n equals the accuracy required of the circuit in bits. Consequently, transistors for an IC that must provide 8-bit performance should have a βV_A product of at least 256, while 12-bit performance requires a product of about 4000. In a manner similar to the way they work their way around low BV_{CEO}s, top analog IC designers can work their way around these potential accuracy limits—but not without complicating the design.



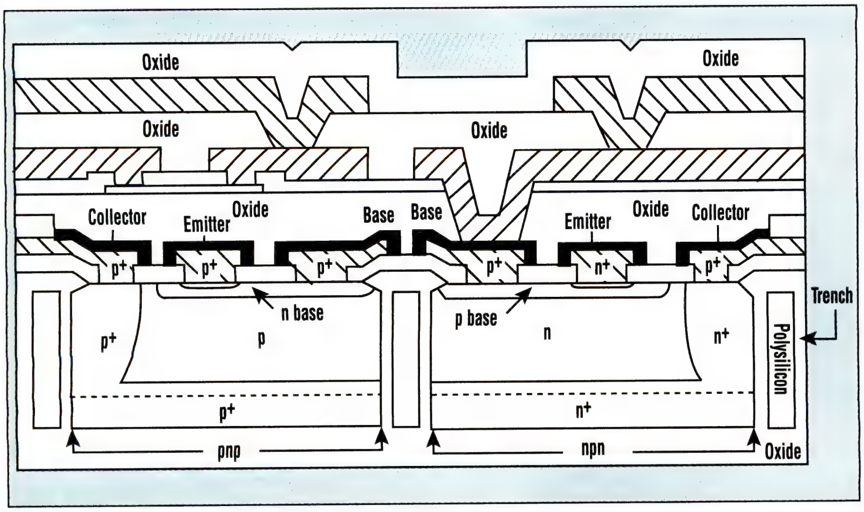
5. THIS POWER IC CIRCUIT designed by National Semiconductor, can switch 1.5-A, 80-mH inductive loads and clamp any turn-off transients to 72 V. It features a suite of patented self-protection features that handle the effects of stray inductances.

SUBSTRATE ISOLATION

The designers of the Tektronix process, called C-SHPI, added a vertical pnp transistor to an existing analog npn process called SHPI. The npn and pnp transistors' βV_A are 2160 and 330, respectively. This is based on a beta of 120 for the npn transistors and a beta of 30 for the pnp transistors. Major design goals included both performance and manufacturability.

The process placed the pnp transistor in a lightly doped n well to achieve the required substrate isolation. A silicon implant is followed by a boron implant to create the p^+ region. That silicon implant helps prevent damage to the crystal structure, which typically occurs during high-dose boron implants.

The silicon implant also permits a much lower buried-layer sheet resistance than would have been feasible without the silicon/boron implant. That's because when followed by a low-temperature regrowth cycle and



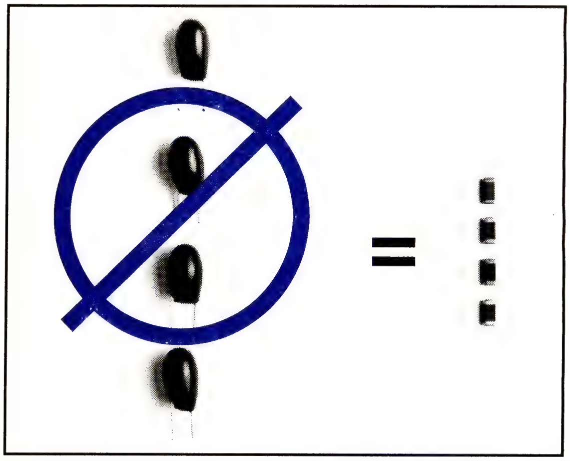
4. SOME HIGH-SPEED ANALOG ICs need ±15-V rails. To fill that need, UTMC created the first 40-V complementary process on bonded wafers. The npn's and pnp's f_ts run 3 GHz and 2 GHz, respectively.

INDUSTRY STANDARD +5V RS-232 NOW OPERATES WITH 0.1µF CAPS!

Save Money and Reduce Board Space

Maxim's new MAX200 family of RS-232 transceivers uses tiny, inexpensive 0.1µF external capacitors instead of the bulky, expensive 4.7µF and 10µF capacitors previously required. And, the MAX200-MAX211 are compatible with the industry standard MAX230-MAX241 in pinout and function.

- **Works with 0.1µF to 10µF Capacitors**
- **Industry-Standard MAX23x Pinout**
- **Priced Same or Lower than MAX23x**
- **Narrow SO Package (MAX202)**
- **SSOP Package (MAX206, MAX207, MAX208, MAX211, MAX213)**



Choose the Best 0.1µF RS-232 Transceiver for Your Design

New Industry Standard	Industry Standard	RS-232 Drivers/Receivers	External Caps (0.1µF)	Description
MAX200	MAX230	5/0	4	5 drivers with shutdown
MAX201	MAX231	2/2	2	Standard +5V/+12V or battery supplies
MAX202	MAX232	**2/2**	**4**	**Industry standard MAX232 pinout**
MAX203	MAX233	2/2	none	No external caps
MAX204	MAX234	4/0	4	4 drivers: replaces 1488 in +5V system
MAX205	MAX235	5/5	none	No external caps
MAX206	MAX236	4/3	4	Ideal for modems: available in SSOP
MAX207	MAX237	5/3	4	Ideal for modems: available in SSOP
MAX208	MAX238	4/4	4	Ideal for printers: available in SSOP
MAX209	MAX239	3/5	2	Standard +5V/+12V or battery supplies
MAX211	MAX241	4/5	4	Complete +5V/AT port SSOP package
MAX213	MAX241	4/5	4	MAX211 + 2 receivers active in shutdown

INTERFACE

ANALOG DESIGN GUIDE

+3V Receivers Stay Active In Shutdown

Throw Away Your Expensive 1488s, 75175s, 145406s ...

New Edition!

FREE* Interface Design Guide – *Sent Within 24 Hrs!

Includes: Data Sheets and Cards for Free Samples

CALL TOLL FREE 1-800-998-8800

For a Design Guide or Free Sample

MasterCard® and Visa® are accepted for Evaluation Kits or small quantity orders.

MAXIM

Maxim Integrated Products, 120 San Gabriel, Sunnyvale, CA 94086, (408) 737-7600, FAX (408) 737-7194.

Distributed by Arrow, Bell, Digi-Key, Elmo, Hamilton Hall-Mark, and Nu Horizons. Authorized Maxim Representatives: **AL,** M-Squared, Inc.; **AZ,** Techni Source Inc.; **CA,** Mesa, Pro Associates, Inc., Centaur Corporation; **CO,** Component Sales; **CT,** NRG Limited; **DE,** TAI Corporation; **FL,** Sales Engineering Concepts; **GA,** M-Squared, Inc.; **ID,** E.S. Chase; **IL,** Heartland Technical Marketing Inc.; **IN,** Technology Marketing Group; **IA,** JR Sales Engineering, Inc.; **KS,** Delltron; **LA,** BP Sales; **MD,** Micro-Comp, Inc.; **MA,** Comp Rep Associates; **MI,** Micro Tech Sales; **MN,** Mel Foster Technical Sales, Inc.; **MS,** M-Squared, Inc.; **MO,** Delltron; **MT,** E.S. Chase; **NE,** Delltron; **NV** (Reno, Tahoe area only) Pro Associates, Inc.; **NH,** Comp Rep Associates; **NJ,** Parallax, TAI Corporation; **NM,** Techni Source Inc.; **NY,** Parallax, Reagan/Compar; **NC,** M-Squared, Inc.; **OH,** Lyons Corporation; **OK,** BP Sales; **OR,** E.S. Chase; **PA** (Pittsburgh area) Lyons Corporation, (Philadelphia area) TAI Corporation; **SC,** M-Squared, Inc.; **TN,** M-Squared, Inc.; **TX,** BP Sales; **UT,** Luscombe Engineering Co.; **VA,** Micro-Comp, Inc.; **WA,** E.S. Chase; **WI,** Heartland Technical Marketing, Inc.

Distributed in Canada by Arrow. Authorized Maxim Representative in Canada: Tech Trek.

Maxim is a registered trademark of Maxim Integrated Products. © 1993 Maxim Integrated Products

CIRCLE 349 FOR U.S. RESPONSE

CIRCLE 350 FOR RESPONSE OUTSIDE THE U.S.

high-temperature diffusion, defect density in the n epitaxial layer (which is grown later) is minimal.

Like several of the previous processes, the base for the Tektronix C-SHPI process is created with a low-energy BF_2 implant, followed by RTA. Vanadium silicide forms the metallic contacts and the technology's Schottky diodes. These process steps are followed by two layers of gold-interconnection metal laid out on a 4-μm pitch.

CLASSIC SUPPLY RAILS

While the application of many of today's analog ICs permit circuits built on processes with a BV_{CEO} between 5 and 10 V (for example, video and RF tasks), a number of applications still require classic ±15-V supply rails. For example, many imaging and data-acquisition applications now demand high speed as well as high precision.

With that in mind, a team from United Technologies Microelectronics Center (UTMC), Colorado Springs, Colo., has come up with a high-speed/wideband process featuring a BV_{CEO} of 40 V. The process, called ACUTE, combines the use of trench isolation with fabrication on bonded, silicon-on-insulator (SOI) wafers, a form of dielectric isolation (DI). This is only the third announcement of a bonded-wafer process. It follows an announcement by Harris Semiconductor by about 21 months and is concurrent with that of Analog Devices (ELECTRONIC DESIGN, *Sept. 2, p. 39)*. However, while Harris Semiconductor developed their own wafer-bonding technology, UTMC (and Analog Devices) employs wafers from Shin-Etsu Handotai Co., Tokyo, Japan.

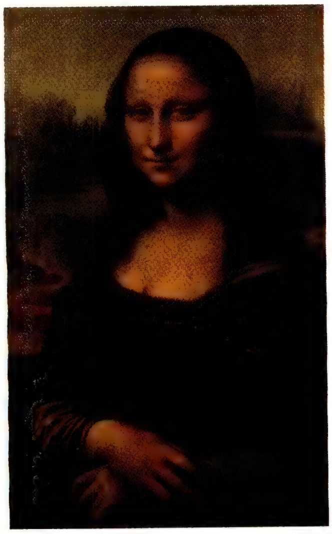
25 V AND UP

In addition to the BV_{CEO} of 40 V, ACUTE's npn and pnp transistors sport f_ts of 3 and 2 GHz, respectively. The βV_A product of the npn transistor runs 30,000 V, that of the pnp transistors 2000 V, based on betas of 150 and 80, respectively.

In this and other bonded-wafer processes, the trenches are etched from the surface of a thinned transistor-quality silicon wafer down to the oxide that's buried between the two wafers *(Fig. 4)*. As a result, silicon dioxide isolates each transistor from each other.

ICs built on these types of complete DI or SOI processes are free from the typical ac and dc parasitics of junction-isolated (JI) devices. These parasitics limit speed and bandwidth and can cause latch-up problems when exposed to high temperature, high voltage, or ionizing radiation.

The technology features complementary twin wells containing complementary twin buried layers and collector plugs. The trench is etched down to the buried oxide through approximately 5-6 μm of silicon, includ-



VISIBLY SUPERIOR LCD MODULES.

See Quality Without Question.

You can also choose from the largest selection of LCD modules in the industry. Just look over these formats and options:

CHARACTER MODULES

8x1	16x1	20x1	24x1	32x1	40x1
8x2	16x2	20x2	24x2	32x2	40x2
	16x4	20x4			40x4

GRAPHIC MODULES

64x480	128x480	640x480	320x240
64x256	128x256	640x400	320x200
64x128	128x128	640x200	
	128x32		

AVAILABLE OPTIONS

- E/L, LED & CCFL backlighting
- Extended Temperature
- B/W STN, Color STN, Normal STN, TN fluid
- Top view or Bottom view

With more than 15 years of experience in LCD manufacturing, we can deliver competetively priced, high quality LCD modules with very short lead times.

Ask us for our catalog or specific product details. You will get visibly superior displays that put a smile on your face.

HANTRONIX

250 Santa Ana Court, Sunnyvale, CA 94086
Tel: (408) 736-3191 ◆ Fax: (408) 749-0477

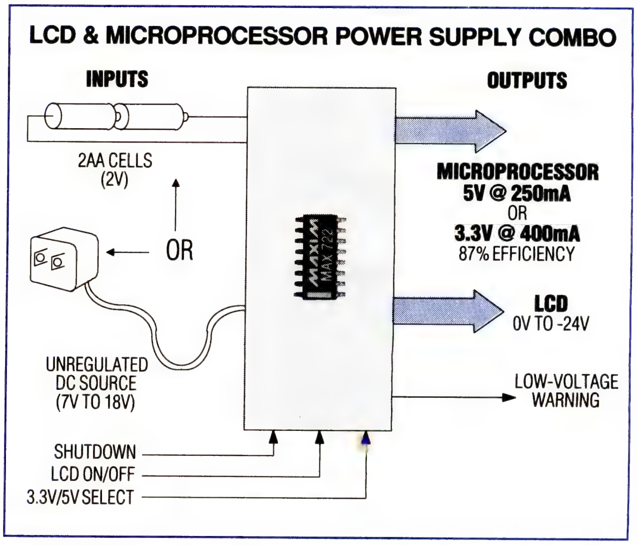
CIRCLE 122 FOR U.S. RESPONSE
CIRCLE 123 FOR RESPONSE OUTSIDE THE U.S.

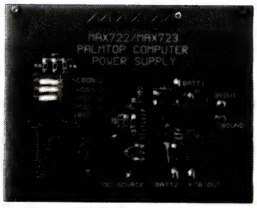
SINGLE CHIP LCD & PROCESSOR SUPPLY HAS 87% EFFICIENCY

Regulated 3V or 5V and 0V to -24V From a 2V Battery

The MAX722/MAX723 dual-output switching regulators provide an unbeatable combination of high efficiency, low supply current, and small size. They fit perfectly in your palmtop computer and other battery-powered equipment designs. Integrated features include low-voltage warning and automatic switching between battery-power and wall adapter power.

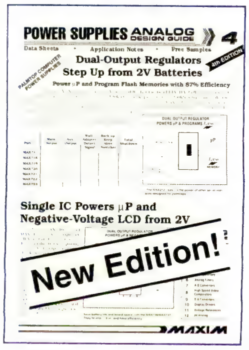
- **Main Output**
  - **3.3V or 5V – MAX722**
  - **3V or 5V – MAX723**
- **LCD Output: 0V to -24V**
- **87% Efficiency**
- **60μA Quiescent Current**
- **20μA Shutdown Mode**
- **Logic-Controlled Outputs**
- **Small 16-Pin SOIC**
- **$5.45***


LCD & MICROPROCESSOR POWER SUPPLY COMBO
INPUTS
OUTPUTS
2AA CELLS (2V)
OR
UNREGULATED DC SOURCE (7V TO 18V)
MAXIM MAX722
MICROPROCESSOR 5V @ 250mA OR 3.3V @ 400mA 87% EFFICIENCY
LCD 0V TO -24V
LOW-VOLTAGE WARNING
SHUTDOWN
LCD ON/OFF
3.3V/5V SELECT



Evaluation Kit Speeds Design Cycle

The complete, preassembled, surface-mount MAX722 evaluation kit saves hours of component gathering, board assembly and design time. It has all the components needed to build your portable power supply (including inductors and PC board). Order MAX722EVKIT-SO, $30.00.



POWER SUPPLIES ANALOG DESIGN GUIDE 4

Data Sheets • Application Notes • Free Samples

PALMTOP COMPUTER POWER SUPPLIES

4th EDITION

Dual-Output Regulators Step Up from 2V Batteries

Power μP and Program Flash Memories with 87% Efficiency

Single IC Powers μP and Negative-Voltage LCD from 2V

New Edition!

MAXIM

FREE Power Supplies Design Guide – *Sent Within 24 Hrs!*

Includes: Data Sheets and Cards for Free Samples

CALL TOLL FREE 1-800-998-8800

For a Design Guide or Free Sample

MasterCard® and Visa® are accepted for Evaluation Kits or small quantity orders.

MAXIM

Maxim Integrated Products, 120 San Gabriel, Sunnyvale, CA 94086, (408) 737-7600, FAX(408) 737-7194.

Distributed by Arrow, Bell, Digi-Key, Elmo, Hamilton Hall-Mark, and Nu Horizons. Authorized Maxim Representatives: **AL,** M-Squared, Inc.; **AZ,** Techni Source Inc.; **CA,** Mesa, Pro Associates, Inc., Centaur Corporation; **CO,** Component Sales; **CT,** NRG Limited; **DE,** TAI Corporation; **FL,** Sales Engineering Concepts; **GA,** M-Squared, Inc.; **ID,** E.S. Chase; **IL,** Heartland Technical Marketing Inc.; **IN,** Technology Marketing Group; **IA,** JR Sales Engineering, Inc.; **KS,** Delltron; **LA,** BP Sales; **MD,** Micro-Comp, Inc.; **MA,** Comp Rep Associates; **MI,** Micro Tech Sales; **MN,** Mel Foster Technical Sales, Inc.; **MS,** M-Squared, Inc.; **MO,** Delltron; **MT,** E.S. Chase; **NE,** Delltron; **NV** (Reno, Tahoe area only) Pro Associates, Inc.; **NH,** Comp Rep Associates; **NJ,** Parallax, TAI Corporation; **NM,** Techni Source Inc.; **NY,** Parallax, Reagan/Compar; **NC,** M-Squared, Inc.; **OH,** Lyons Corporation; **OK,** BP Sales; **OR,** E.S. Chase; **PA** (Pittsburgh area) Lyons Corporation, (Philadelphia area) TAI Corporation; **SC,** M-Squared, Inc.; **TN,** M-Squared, Inc.; **TX,** BP Sales; **UT,** Luscombe Engineering Co.; **VA,** Micro-Comp, Inc.; **WA,** E.S. Chase; **WI,** Heartland Technical Marketing, Inc.

Distributed in Canada by Arrow. Authorized Maxim Representative in Canada: Tech Trek.

* 1000-up, US recommended resale.

Maxim is a registered trademark of Maxim Integrated Products. © 1993 Maxim Integrated Products

CIRCLE 347 FOR U.S. RESPONSE

CIRCLE 348 FOR RESPONSE OUTSIDE THE U.S.

PICO

New

100 Watt DC-DC Converter Modules

Single and DUAL Isolated Outputs

Wide Input Voltage Range Models from 18 to 380 VDC

Over 68 standard models

Special voltage combinations available

Parallel operation

Fixed frequency

Fully regulated

Short circuit protected

True redundancy operation

*See EEM or send direct for **Free** PICO Catalog.*

Call toll free **800-431-1064**

in NY call **914-699-5514**

FAX **914-699-5565**

PICO Electronics, Inc.

453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552

CIRCLE 308 FOR U.S. RESPONSE
CIRCLE 309 FOR RESPONSE OUTSIDE THE U.S.

WANT TO GO?

For registration information, contact Janis Jopke at Conference Coordination Services, 6611 Countryside Dr., Eden Prairie, MN 55346. Phone: (612) 934-5082; fax: (612) 934-6741.

ing the buried layers. The layers are formed in a 2-μm layer of silicon on the 1-μm-thick buried oxide. The 2-μm-wide trench can support 250 V after its sidewalls are oxidized and the space between them backfilled with polysilicon.

The V_{be} match between transistors from the process runs better than ±500 mV. This is more than low enough for most high-speed/wideband op amps.

LOWER VOLTAGE

Not all "high-voltage," wideband, analog IC applications need complementary transistors that handle 40 V between the supply pins. Using techniques borrowed from many of the previously described low-voltage processes, a team at Philips Semiconductors (session 8.3), developed a process that builds npn transistors with an f_t of 5.5 GHz at a collector-to-emitter voltage of 26 V. Their Early voltage runs from 160 to 180, while β is between 50 and 70. Moreover, that β specification holds over seven decades of collector current totaling up to 100 μA.

Thus, the βV_A product of the process's npn transistors runs in excess of 12,000. That's the highest yet reported for devices with f_ts above 5 GHz, and twice that of the low-voltage bonded-wafer processes. BV_{CEO} is 30 V and BV_{CBO}, also important for analog circuits, is 60 V.

These transistors are fabricated in a lightly doped epitax that's 4 μm thick. The resistance of its antimony-doped sub-collector (buried layer) runs 18 Ω/square, which is linked to the collector contact with a deep plug diffusion. Its intrinsic base is ion implanted through a barrier oxide at low energy to minimize structural damage. The oxide is stripped and a layer of polysilicon is deposited and doped with an arsenic implant. The polysilicon is patterned and an anneal activates the emitter dopant to form the emitter junction. Following several additional steps, active regions are silicided with platinum.

A UNIQUE POWER IC

Driving inductive loads (turning them on and off) isn't a favorite task of general-purpose ICs. However, an international two-person team from National Semiconductor, Greenock, Scotland and Santa Clara, Calif., describes a dual high-current driver IC, with each half being rated at 20 V and 1.5 A *(Fig. 5)*.

Besides the high current ratings, each driver section can also clamp transients. For inductances up to 80 mH, each section can clamp turn-off transients at 72 V and 1.6 A while dissipating up to 116 W for up to 2.4 ms.

The IC's suite of self-protection and alarm circuits includes a current-limit/short-circuit-output flag that also turns off the power switch, and an open-circuit detector and flag. The IC also has an output-overvoltage detector circuit that senses when the output exceeds 28 V and turns off the drive to the npn-transistor output switch.

This IC contains a unique set of circuits. These circuits can prevent severe momentary overheating (and eventual demise) of the npn output transistor, caused by repetitive cycling from OFF to ON states due to overvoltage.

The circuits sense the condition of an overvoltage at the output—at a time when the input signal to the system is still HIGH, commanding the output to go low. When this occurs, after the detectors and the gates sense that the output is in an overvoltage state while the input is HIGH, the output is turned OFF and latched OFF until the next input pulse is applied.

This procedure minimizes power dissipation at high currents during repetitive dV/dt occurences. In addition, a short circuit from the output pin to the 20-V power-supply rail with a load of 4 to 400 μH doesn't damage the chip.☐

HOW VALUABLE?	CIRCLE
HIGHLY	529
MODERATELY	530
SLIGHTLY	531

CIRCLE 260 FOR U.S. RESPONSE →
CIRCLE 261 FOR RESPONSE OUTSIDE THE U.S. →

© International Business Machines Corporation 1993

International Business Machines Corporation
Route 100, P.O. Box 100
Somers, NY 10589

Printed in the United States of America
1993
All Rights Reserved

The following terms denoted by SM, TM or ® in this publication are trademarks of IBM in the United States and/or other countries: IBM Microelectronics, Total Technology Solutions, Mwave, PowerPC, PowerPC 601, ThinkPad and Blue Lightning.

Intel is a registered trademark of Intel Corporation.
Pentium is a trademark of Intel Corporation.
Motorola is a registered trademark of Motorola, Inc.
Apple is a registered trademark of Apple Computer, Inc.

All performance data contained in this publication was obtained in a specific environment, and is presented as an illustration. The results obtained in other operating environments may vary.

1993

IBM Technology Products enters the OEM market with a unique philosophy—*Total Technology Solutions*—and a new name, IBM Microelectronics.

full-service capabilities as global procurement, prototyping, production, delivery management and advanced testing services.

Of course, all this merely scratches the surface when it comes to services. Our solutions are second to none, and include such exclusive offerings as state-of-the-art, multi-chip module test & stress services. We also offer complete thermal management resources encompassing design, modeling and analysis, and thermal laboratory services.

Finally, because access to innovation is as important as innovation itself, IBM Microelectronics is supported by one of the industry's most knowledgeable, responsive sales force and distributor networks. In addition, we provide comprehensive, local access through experienced field application engineers and a network of strategically located regional design centers.

For more information about IBM Microelectronics and *Total Technology Solutions*, please call **1-800-IBM-0181**. Now that we've introduced ourselves, we'd like to get down to business.

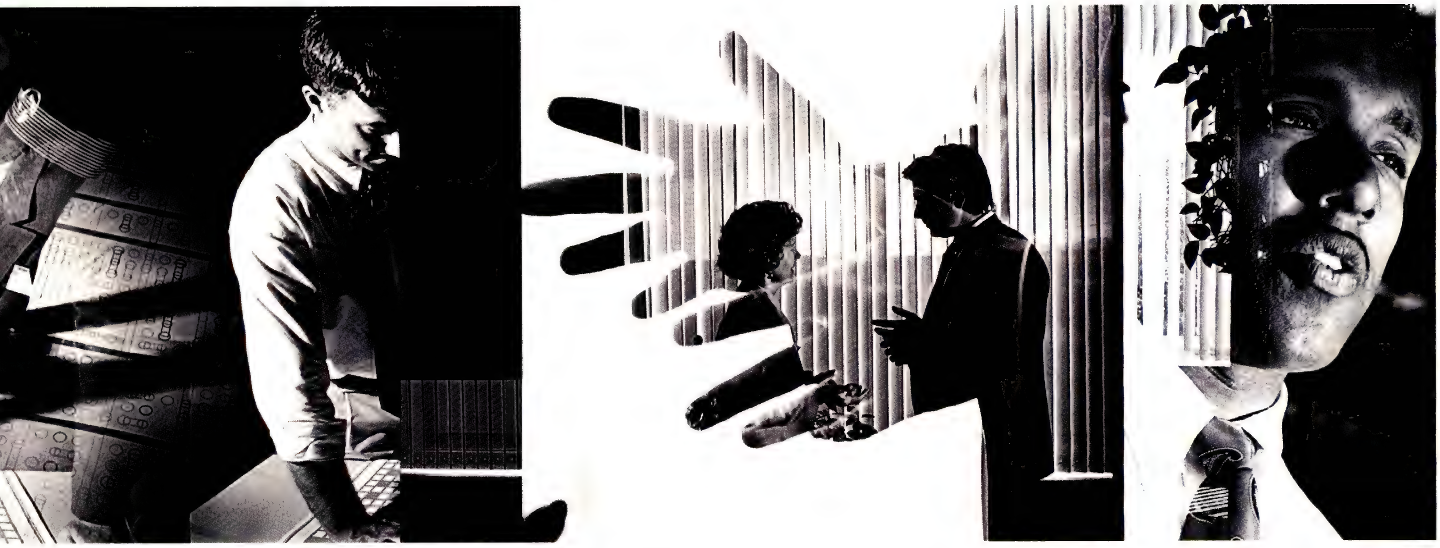
1992

IBM's PowerPC 601 microprocessor is the first in a family of RISC-based, PowerPC microprocessors designed for personal computing applications.

as our 0.5 micron CMOS 5L process. The way we see it, *Total Technology Solutions* are possible when customers can access not just technologies, but the tools, support and guidance only our microelectronics expertise can deliver.

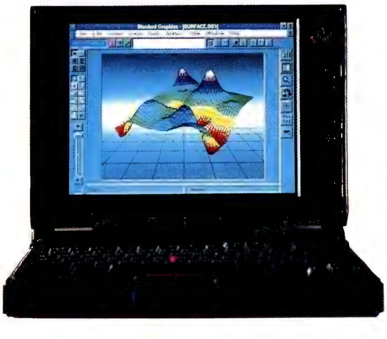
A prime example of this philosophy is our ASIC design support capability. We offer high-performance ASIC libraries where customers can select from a complete range of gate array and standard cell primitives, I/O's, latches, registers and RAMs. Advanced ASIC design kits are also available for a variety of industry standard CAD tools.

Yet these services tell only part of the story. To enable circuit designers to achieve their goals, we provide design services teams staffed by our ASIC professionals. Depending on customer needs, our teams can assist with everything from physical design to delay calculation/timing optimization and test generation.

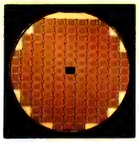


Another area where IBM resources and experience provide tangible, value-added benefits is our Electronic Card Assembly & Test (ECAT) facility in Charlotte, North Carolina.

Ideal for customers needing turnkey card solutions, ECAT offers an exceptional list of design services for requirements ranging from single function adaptor cards to system motherboards. In addition, ECAT uses an industry-leading Design For Manufacturability (DFM) process for optimum cost and quality. This remarkable facility even provides such

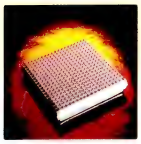


Our advanced systems are at the heart of such breakthroughs as IBM's ThinkPad™ Model 700C notebook computer.



IBM introduces the 0.8 Micron ASIC with 400K circuits, allowing entire macro logic functions to be placed on a single chip.

1990



We introduce ball grid array (BGA) packaging, an extension of C-4 technology offering high quality yields for I/O intensive applications.

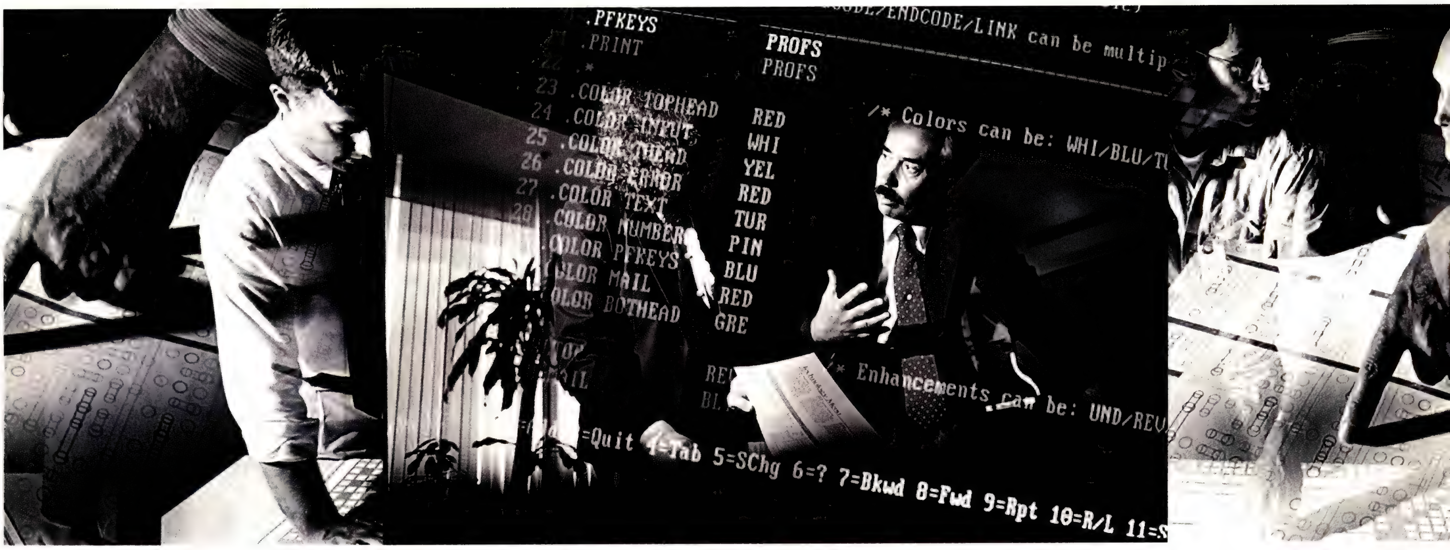
1991

at any point in the packaging cycle, including design, modeling, pilot, prototype and production services, plus completed subassemblies. What's more, we're equipped to optimize products for thermal, mechanical and electrical performance, using IBM or industry standard chip sets.

What more can we do to convince you?

The products you've just read about are only a few of the innovative solutions awaiting customers at IBM Microelectronics. The fact is, these few pages simply can't do justice to all the resources and technologies we offer.

Take our extensive family of memory products, for instance.



Fabricated in an advanced CMOS silicon gate process, our products deliver outstanding performance and reliability with low power dissipation. Our DRAM capability is particularly impressive, offering substantial performance benefits and cost savings. For even greater development ease, our memory products are available in assembled form as SIMMS, memory cards and custom boards. And with numerous subsystem memory patents and 15 years of high-performance implementation under our belts, we can meet even the most demanding customer requirements.

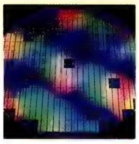
Our Mwave™ technology is another IBM innovation. The industry's leading hardware/software platform for integrating multimedia functions into PCs, Mwave technology is designed to offer strategic software upgrades as the multimedia market grows. So customers can keep pace with applications without investing in new hardware.

Our services mean everything to customers.

At IBM Microelectronics, the line between products and services is as thin

1979

IBM introduces the Multi Layer Ceramic (MLC) Multi-Chip Module (MCM), which incorporates up to nine chips and 23 ceramic layers.



1986

IBM brings 8-inch wafers into the manufacturing line, which greatly increases yields and productivity.

Yet perhaps the most impressive example of IBM Microelectronics' leadership is our recently introduced 0.5 micron CMOS 5L Process. A first in ASIC technology, the CMOS 5L uses as many as five levels of metal interconnections to achieve densities up to an unprecedented 1.3 million usable gates. So designers can integrate more functions onto a single device.

IBM Microelectronics. The total package.

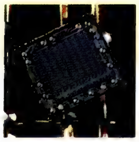
Of course, all the innovation in the world means little when performance is compromised by packaging. So at IBM Microelectronics, we've spent years building the industry's most complete, customer-driven resource.

This is *Total Technology Solutions* at its finest. With our integrated options, customers get the most from their designs, while reducing system size and total cost.

For instance, IBM Microelectronics offers a vast array of package types and interconnection choices. Depending on their needs, designers can select such package types as ball grid arrays, flat packs, pin-grid arrays and a variety of multi-chip modules. Our chip-to-package interconnection options include wire-bond, Tape Automated Bonding (TAB) and flip chip (C-4), and extend to such package materials as plastic, polyimide, ceramics and laminates. We also offer a full line of printed circuit boards from thin/light cards for portable systems to advanced technology panels for performance-driven applications.

But our packaging products aren't the only reason IBM is so respected within the industry. Unlike ordinary suppliers, we have the vision and expertise to assist customers

IBM uses its leading-edge glass ceramic packaging technology to create MCM-C substrates.


1971

We introduce the world's first semiconductor main memory, the primary technology used today.

1979

IBM's early 70's invention of RISC bears fruit with our 1979 introduction of the first experimental system.

But that's just the beginning. IBM Microelectronics is extending its acclaimed PowerPC architecture into embedded processor solutions which will include a family of embedded processors and software development tools. So designers of embedded systems can build in the high performance benefits of RISC at a competitive cost.

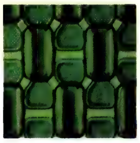
Our commitment to ASIC solutions is quite specific.

In today's microelectronics market, ASIC performance is no longer a luxury, it's a necessity. Yet finding a supplier with the know-how and track record to design and manufacture ASIC solutions is no easy task.

At IBM Microelectronics, we're convinced we offer the industry's most advanced, comprehensive ASIC resource. Our process technologies encompass high-performance, high-density CMOS and BiCMOS ASICS. They also include a full line of analog and mixed signal products perfectly suited for analog/digital mixed-mode applications.

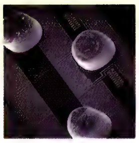
IBM Microelectronics also provides the world's most extensive circuit library, ranging from a complete selection of primitive logic functions to such enhanced functions as 10-bit registers. A variety of dense SRAM functions are also available, as well as software-generated RAM functions.

To help designers take full advantage of our ASIC prowess, we also offer an advanced series of design kits for use with industry standard EDA tools. These ASIC design kits provide interfaces between our world-renowned ASIC product line and the design entry, simulation, synthesis and timing design platforms available from a number of respected industry names.



1967

IBM invents the one transistor memory cell (DRAM) for increased memory density at a lower cost.



1969

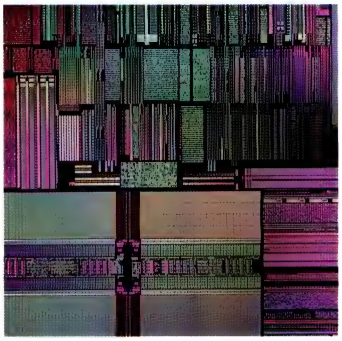
Our invention of Controlled Collapse Chip Connection (C-4) creates dense array chip connections with superior reliability.

16KB of on-chip cache plus a two-to-one internal clocking option for operation at twice the bus frequency.

Equally impressive is our Blue Lightning™ subsystem family, which features the world's fastest 486. It uses exclusive clock-tripling and offers twice the internal cache as our competitor's top-of-the-line X86.

Another compelling argument for our leadership in microprocessors is best expressed in two words: PowerPC™ technology.

Created by IBM in alliance with Apple and Motorola, PowerPC technology harnesses advanced RISC (Reduced Instruction Set Computing) architecture to deliver unprecedented processing speeds, low design-in cost and minimal power consumption. As proof of its impact, Apple announced it will use PowerPC technology throughout its product line. In addition, IBM recently announced the formation of a new division—Power Personal Systems—to oversee the development, manufacturing and marketing of personal computers based on PowerPC technology. And *Byte* magazine honored PowerPC technology with its "Most Significant Technology" award at the 1993 COMDEX Spring Computer Show.

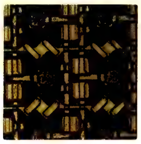


IBM brings the benefits of RISC into the mainstream with PowerPC technology.

PowerPC technology is currently available in our PowerPC 601™ microprocessor, supported by a full set of development tools. One-third faster than Intel's much-publicized Pentium™ microprocessor, the 601 microprocessor runs 50% cooler, uses one-half the power and costs roughly half as much.

1959

IBM designs the world's first fully automated transistor production line.



1964

IBM "flip chip" interconnection technology enables production-level chip joining of discrete transistors to SLT substrates (64-bit FET memory chip shown).

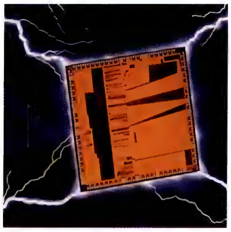
Total Technology Solutions

As you can see from the timeline at the top of this page, we're not exactly newcomers to microelectronics. Over the past 30 years, in fact, IBM Microelectronics has developed many of the industry's most significant "firsts" in semiconductors, packaging and electronics manufacturing technologies.

That being said, we're intelligent enough to realize that in a business as competitive as ours, we must build on the past, not live in it. That's why we've changed our name from the familiar IBM Technology Products to the more definitive IBM Microelectronics. And why, as we enter the commercial market, we make this single, steadfast pledge to our customers and ourselves: To be the world's most innovative, integrated microelectronics supplier.

We've fast become the power in microprocessors.

Anyone searching for proof of our commitment to microelectronics should begin by examining our line of 386 and 486 microprocessor-based systems. They'll discover no other systems deliver such an extraordinary combination of price/performance, flexibility and functionality. And here's something the competition would prefer we not mention. Many of our complete X86 subsystems cost about the same as competitive single chips sold by other suppliers.



Our Blue Lightning subsystem is the world's fastest 486.

A case in point is our industry-leading 486SLC2. Designed as an affordable, low-power PC processor solution, the 486SLC2 features a 32-bit data flow, Here we are.

After months of headlines and hearsay, **IBM Microelectronics**™ has entered the merchant market. With both feet and all the resources in the world.

So let's get down to business. We want to tell you, in plain English, exactly who we are. What we offer. And why we believe IBM Microelectronics is the one supplier with the strengths to meet all your technology needs.

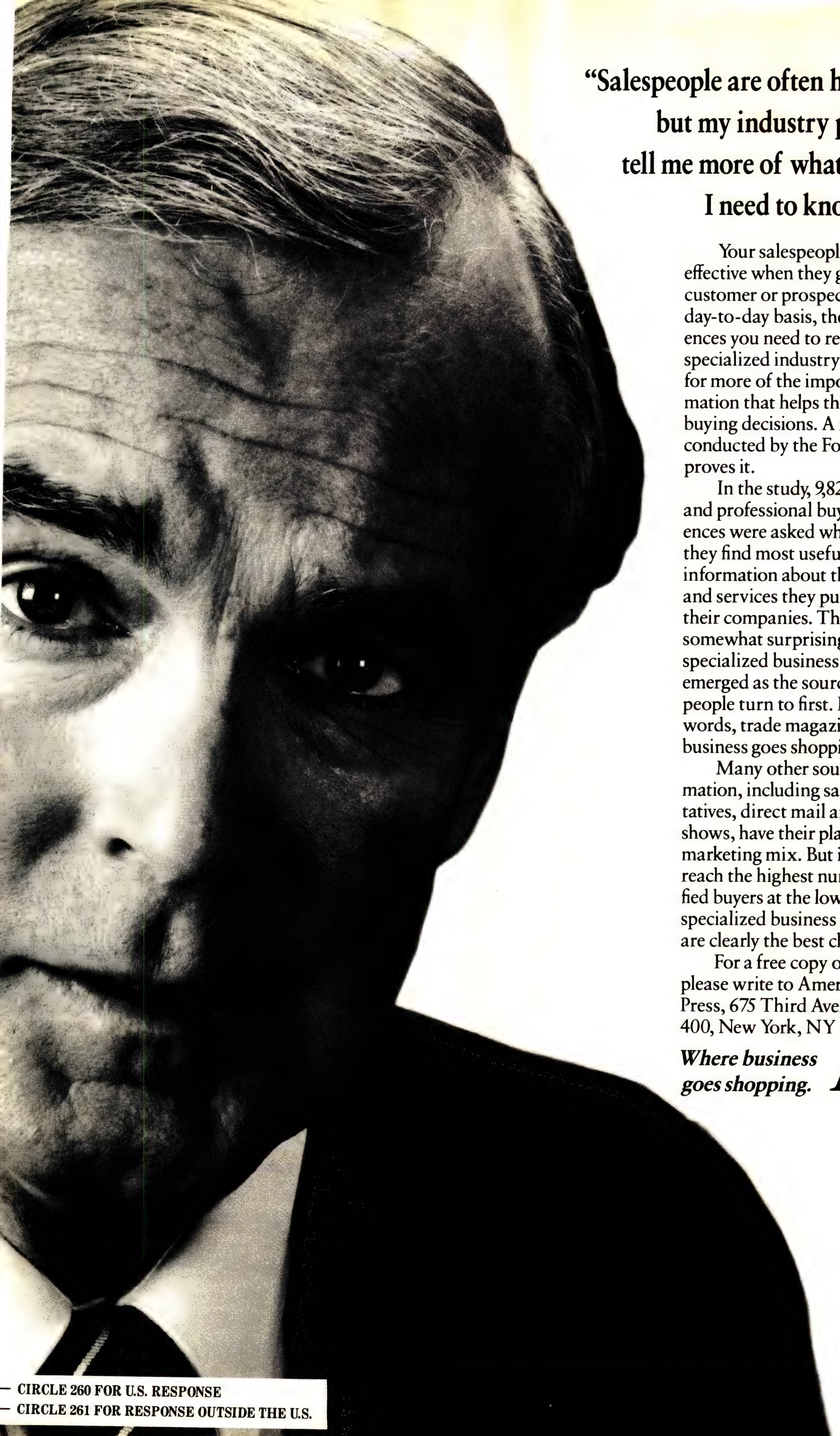
We'll begin with the obvious. For the past 30 years, we've created and manufactured innovative products for IBM, one of the world's largest computer companies. In all that time, there isn't a design, process or packaging problem we haven't seen. Or solved.

Our latest challenge is perhaps our most demanding. But it's one we're supremely equipped to handle. Today's convergence of computers, communications and consumer electronics has created a potent need for suppliers with the vision and muscle to deliver not just parts, but integrated, leading-edge systems.

The answer is something we call *Total Technology Solutions.*℠ In a nutshell, it gives customers unlimited access to our unrivaled silicon, packaging and manufacturing technologies. And it enables us to bring superior subsystems to market faster and more efficiently.

So turn the page to discover all the answers awaiting you at IBM Microelectronics. Together, there's nothing we can't accomplish.

After 30 years of
leading the way in
microelectronics,
it's time we
introduced ourselves.



"Salespeople are often helpful, but my industry publications tell me more of what I need to know."

Your salespeople can be effective when they get to see a customer or prospect. But, on a day-to-day basis, the buying influences you need to reach turn to specialized industry publications for more of the important information that helps them make buying decisions. A recent study, conducted by the Forsyth Group, proves it.

In the study, 9,823 business and professional buying influences were asked what sources they find most useful in providing information about the products and services they purchase for their companies. The results were somewhat surprising. Overall, specialized business publications emerged as the source business people turn to first. In other words, trade magazines are where business goes shopping.

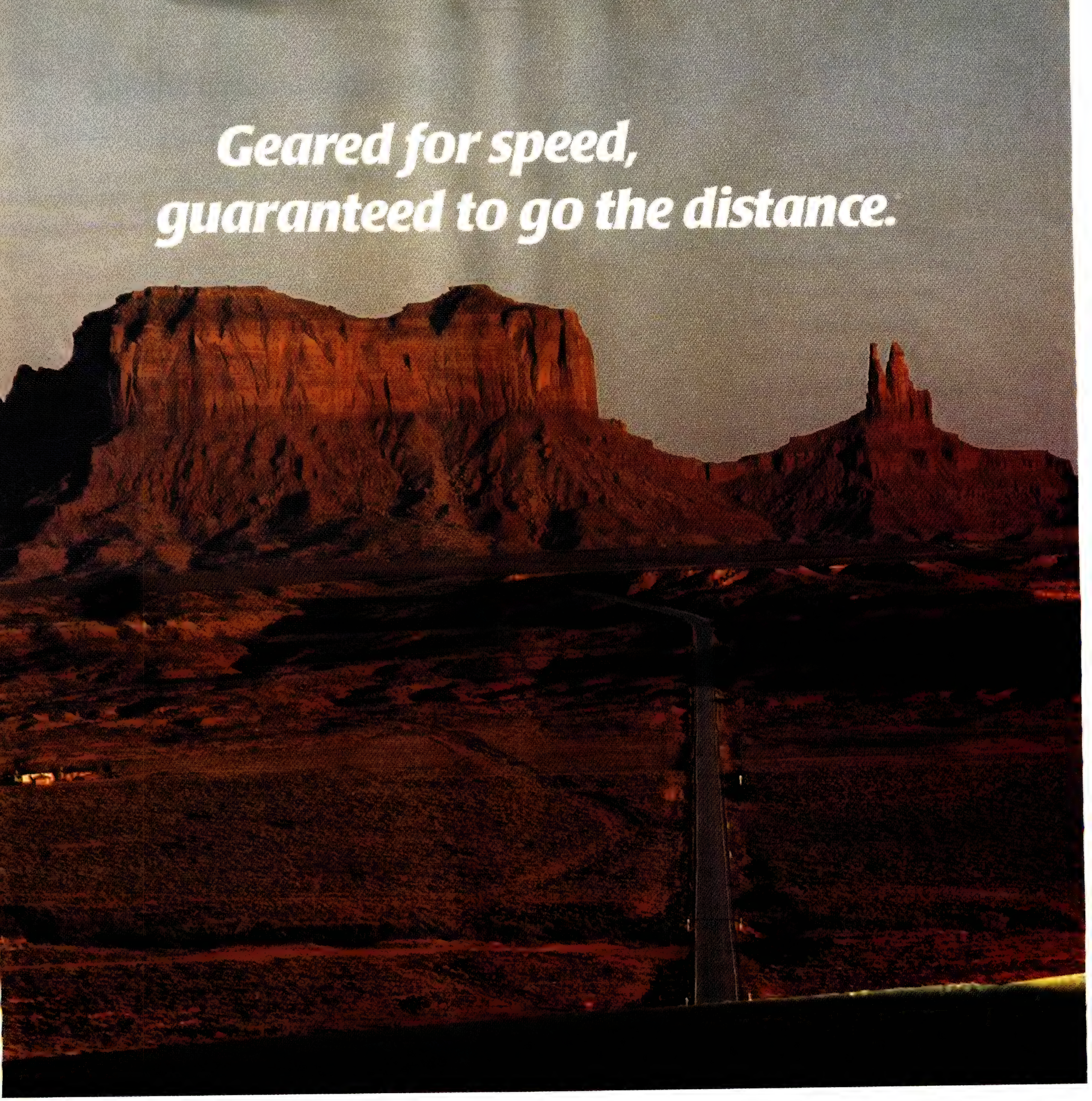
Many other sources of information, including sales representatives, direct mail and trade shows, have their place in the total marketing mix. But if you want to reach the highest number of qualified buyers at the lowest cost, specialized business publications are clearly the best choice.

For a free copy of the study, please write to American Business Press, 675 Third Avenue, Suite 400, New York, NY 10017.

Where business goes shopping. ABP

— CIRCLE 260 FOR U.S. RESPONSE

— CIRCLE 261 FOR RESPONSE OUTSIDE THE U.S.



NEC holds the course in ECL SRAMs.

ECL SRAMs from NEC can play a vital role in speed-intensive products. We're a reliable source, not just for today's product line, but for the future of your systems.

NEC is ready to meet your current needs with a full line of ultra-high-speed ECL SRAMs. We offer a choice of densities – 4K, 16K, 64K and 256K; and interfaces for 10K, 100K and 101K. We even offer synchronous 4K and 256K devices.

Implemented with leading-edge Bipolar and BiCMOS technologies, our ECL SRAMs feature scorching speed and low power consumption. Their quality is certified by the ISO 9001 granted to NEC's semiconductor group.

NEC will support your future needs with continuing product upgrades. Development of 4M GTL/ECL devices is well underway at NEC.

If you're looking for a dependable source of ECL SRAMs, call NEC today.

For fast answers, call us at: USA Tel:1-800-366-9782. Fax:1-800-729-9288. Germany Tel:0211-650302. Fax:0211-6503490. The Netherlands Tel:040-445-845. Fax:040-444-580. Sweden Tel:08-753-6020. Fax:08-755-3506. France Tel:1-3067-5800. Fax:1-3946-3663. Spain Tel:1-504-2787. Fax:1-504-2860. Italy Tel:02-6709108. Fax:02-66981329. UK Tel:0908-691133. Fax:0908-670290. Ireland Tel:01-6794200. Fax:01-6794081. Hong Kong Tel:886-9318. Fax:886-9022. Taiwan Tel:02-719-2377. Fax:02-719-5951. Korea Tel:02-551-0450. Fax:02-551-0451. Singapore Tel:253-8311. Fax:250-3583. Australia Tel:03-8878012. Fax:03-8878014. Japan Tel:03-3454-1111. Fax:03-3798-6059.

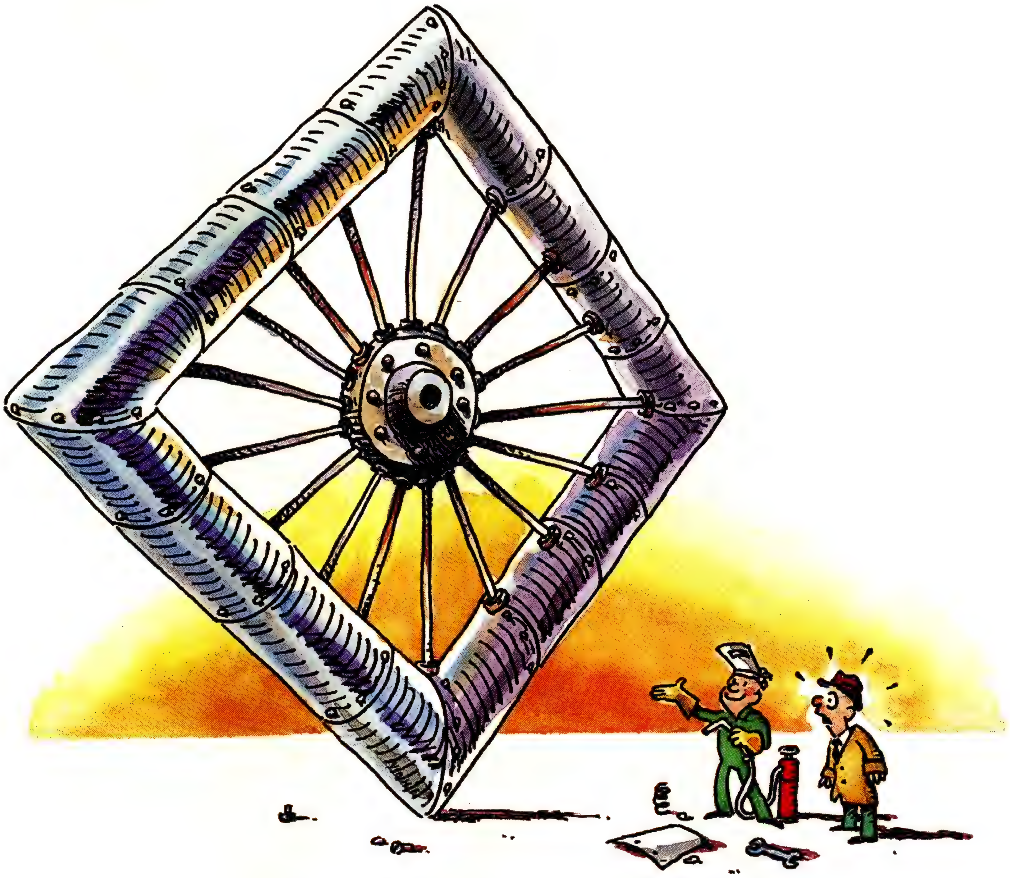
Part number (µP)	B10474A B100474A	B10474E B100474E B101474E	B10476LL* B100476LL*	B10484 B100484	B10484E B10E484 B101484E B101E484	D10494 D100494 D101494	D10504 D100504 D101504	D10509RR* D100509RR* D101509RR*
Organization	1K x 4	1K x 4	1K x 4	4K x 4	4K x 4	16K x 4	64K x 4	32K x 9
Access Time (Cycle Time)	5ns	3/4ns	(7/8ns)	10/15ns	4.5/5ns	6/7ns	8/10ns	(6ns)
Package	24 DIP 24 Flat	24 DIP 24 Flat	28 DIP 28 Flat	28 DIP 28 Flat	28 DIP 28 Flat	28 DIP 28 Flat	28 Flat	52 PLCC
Process	Bipolar	Bipolar	Bipolar	Bipolar	Bipolar	0.8µ BiCMOS	0.8µ BiCMOS	0.5µ BiCMOS

*Synchronous version

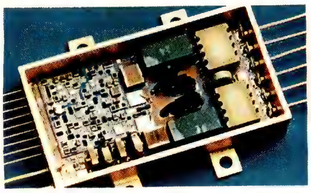
CIRCLE 168 FOR U.S. RESPONSE

CIRCLE 169 FOR RESPONSE OUTSIDE THE U.S.

NEC



If you're reinventing the wheel, reinvent it with the right mechanic.



Up to 60W/in^3 in a 3.5 oz hermetic hybrid package (1.5"x2.74"x0.4").

Let's face it, you've only got a few vendors to choose from. And even fewer, if you're concerned with total quality. Nobody understands this better than Raytheon's Quincy Operations. Our electronic systems and components are synonymous with total quality. So, if you're inventing new ways to stay competitive, you couldn't ask for a better partner than us.

Consider our high-density power supplies. At up to 60 watts per cubic inch and over 86% efficiency, these DC to DC convertors give you the flexibility of distributed power architecture. Our products include 28Vdc and 270Vdc input models with 50W to 100W power configurations and very low ripple noise. And modified standard products can be designed for telecommunications, space and shipboard applications.

What does all this capability mean? It means we're the perfect choice for your new applications. All Quincy high-density power supplies are hermetically sealed in a hybrid package and are NAVMAT derated. In addition, because our high-density power supplies are all produced in our automated facility, they perform even beyond your expectations.

So if you're positioning your product for the future, Raytheon's Quincy Operations can help you get there. Without us, you may just end up spinning your wheels.

Call or write for technical support and applications assistance: Raytheon Company, Quincy Operations, 465 Centre St., Quincy, MA 02169 (617) 984-8508, FAX (617) 984-4196.

Raytheon

WE THRIVE ON CHALLENGES

CIRCLE 256 FOR U.S. RESPONSE

CIRCLE 257 FOR RESPONSE OUTSIDE THE U.S.

THREE-LEVEL CODING AND ADAPTIVE EQUALIZATION NETS 100-MBIT/S TRANSCEIVER DATA RATE OVER EXISTING TELEPHONE LINES.

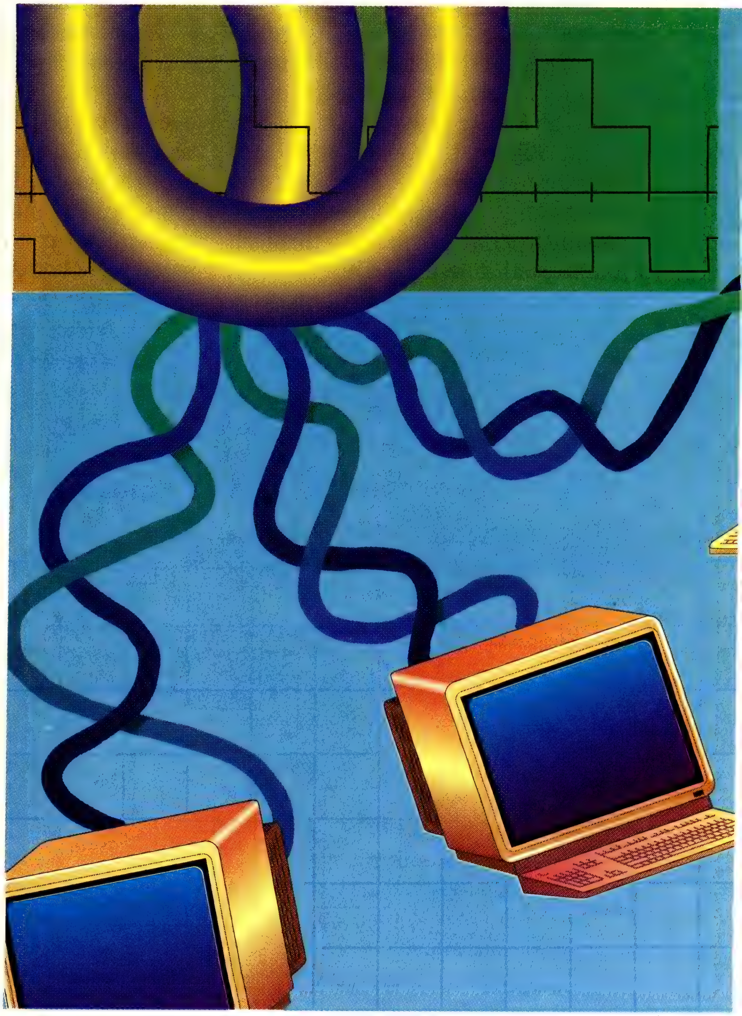
FDDI RIDES TWISTED PAIR TO THE DESKTOP

MILT LEONARD

Workstation and desktop-computer applications, such as bit-mapped color graphics and imaging, multimedia, and CAD/CAM, require high-bandwidth connectivity with other networked elements. The Fiber Distributed Data Interface (FDDI) is the technology of choice for network backbone applications, but extending FDDI's 100-Mbit/s bandwidth to the desktop computer has been stalled by the lack of a viable alternative to costly fiber-optic cable and optical transceivers.

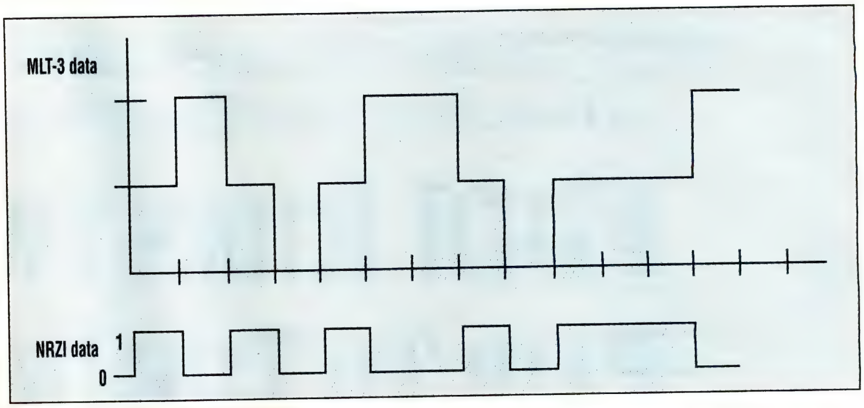
Using existing twisted-pair wiring has long been considered as an alternative solution. Such wiring, though, tends to produce undesirable electromagnetic radiation at high frequencies. To control this radiation, the U. S. Federal Communications Commission limits data transmission rates over copper telephone lines to 30 MHz.

Taking these factors into consideration, the American National Standards Institute (ANSI) developed the X3T9.5 FDDI physical-media-dependent (PMD) standard for twisted-pair wiring, which is now in the final editing stages. The standard allows integrated silicon solutions for twisted-pair FDDI applications. Thus, FDDI can be employed with two types of widely used twisted-pair copper wiring: Category 5 unshielded twisted-pair (UTP-5) data-grade cable used in most 10Base-T Ethernet applications, and Type 1 shielded twisted-pair (STP) cable for token-ring applications.



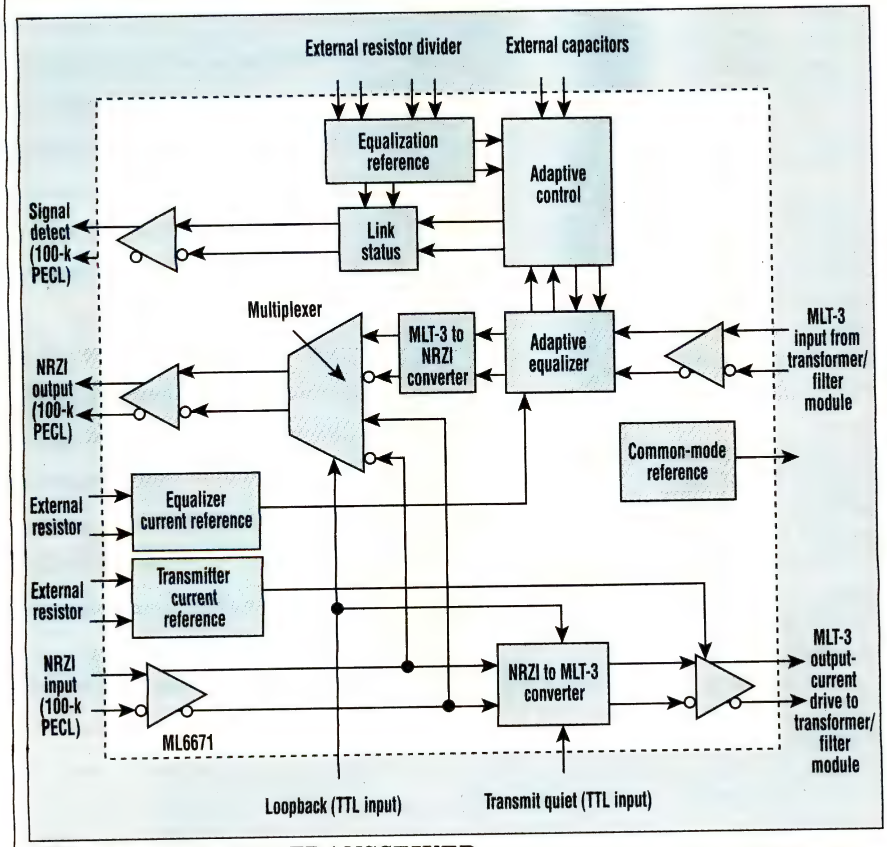
The first transceiver chip design that implements the ANSI FDDI standard has just been developed by Micro Linear Corp. The ML6671 transceiver is designed for 125-Mbit/s data transmission over either type of copper cable *(Fig. 1)*. Located at both ends of a twisted-pair transmission line, the transceiver performs two of the three functions required for FDDI transmission over copper: encoding/decoding and equalization. The encoding and decoding functions are performed using a MLT-3 (multilevel threshold using +1-V, 0-V, and −1-V logic levels) approach.

To minimize electromagnetic-interference (EMI) emissions, the chip's transmit section accepts scrambled two-level NRZI (non-return-to-zero, inverted) data from an external FDDI controller and converts it to MLT-3 three-level line code prior to data transmission *(Fig. 2)*. The EMI is caused by high-speed data traveling over the copper transmission lines. Whenever an NRZI signal changes logic levels, MLT-3 also changes levels. However, because MLT-3 has three levels versus NRZI's two, the maximum fundamental frequency of the MLT-3 is one-half that of NRZI. As a result, this conversion shifts much of spectral energy below 30 MHz. Even more importantly, it reduces the spectral energy between 40 and 70 MHz, the region where NRZI transmission has trouble meeting federal emission standards. With MLT-3 coding, 90% of the spectral energy lies below 40 MHz.



2. MLT-3 ENCODING is used on transmitted data to compress bandwidth, allowing transmissions to comply with FCC EMI regulations. In this type of code, logical ones are represented by voltage-level transitions and zeros are represented by lack of transitions. Transitions are always between two adjacent levels. Compared with the NRZI code, the MLT-3's emission power spectrum is two-thirds smaller.

Following the code conversion, the transmitter output passes through an external low-pass filter and a transformer before entering the connectors to the STP or UTP cable. The transmitted signal's amplitude is programmable through an external resistor. The signal jitter out of the transmitter is typically less than 1.6 ns, which translates to a bit-error rate of 10^{-12} *(Fig. 3)*.



1. IN THIS FDDI TRANSCEIVER, the transmit section converts 100-k pseudo-ECL scrambled NRZI inputs to MLT-3 code. The code is then sent to the twisted-pair transmission line through a transformer/filter module. The receive section of the ML6671 transceiver performs the reverse function, plus adaptive equalization to compensate for line impedance. A TTL loopback input is provided for troubleshooting.

The transceiver's receive section at the other end of the data link accepts MLT-3 signals that pass through an external isolation transformer and a band-limiting filter. Before the data can be converted to NRZI format, adaptive equalization is necessary to compensate for amplitude attenuation and phase distortion of high-speed signals traveling over twisted-pair copper wiring.

With a characteristic impedance of 150 Ω, a 100-meter STP cable attenuates a transmitted signal by –12 dB (a factor of four) at 62.5 MHz. Similarly, a 100-meter UTP-5 cable attenuates the same signal by –18 dB. If a channel is equalized for the maximum length of either cable, it would be over-equalized for shorter cable lengths, causing excessive signal jitter. Adaptive equalization is thus necessary for good signal integrity.

TAMING CABLE IMPEDANCE

The ML6671 performs adaptive equalization by changing the receiver gain and frequency response as a function of the received signal. Peak-to-peak signal amplitudes between 100 mV and 2.0 V are considered valid signals.

The transceiver performs equalization by boosting the high-frequency content of the received signal, and is effective for UTP-5 cable lengths of up to 100 meters. As the received-signal amplitude decreases, the amount of the equalization increases until it reaches its maximum level, which is equivalent to 100 meters of

IT'S CALLED NATURAL SELECTION.

One size *doesn't* fit all

In simulation tools, as in anything else, there comes a time when a once-useful contributor just can't cut it anymore.

Issues like mixed digital and analog signals migrating from board to chip level are forcing general-purpose simulators into extinction. They just haven't been able to adapt. And "kludging" together different simulators from different vendors has been, at best, unrewarding.

That's why Viewlogic offers you the only real survival path. We give you the tools you need to simulate at the component *and* the system level *in the same environment.* You match the best simulation tool to each task, and get instant access to all the information generated across all the tools.

An environment that's open to change

How can we do this? With Viewlogic's SimBus™ — the first simulation backplane that lets you simultaneously integrate a nearly infinite variety of simulation tools — yours, ours, or third-party — into one design environment. With SimBus you get a unified simulation environment that:

- Allows you to select the best simulator for each specific design task;
- Enables you to combine all your simulation capabilities into one comprehensive system solution which you can then run concurrently as one "super simulator." This co-simulation technology lets you attack the problem from as many angles as you like *at the same time;*
- Brings together all the models you need for fast, accurate system simulation, including Verilog HDL, HSPICE, Zycad, VantageSpreadsheet, VHDL, LMC, and others.

The benefits are clear

Best of all, SimBus lets you simulate at *any* point in the design process, using the methodology *you* deem most appropriate.

It also protects your investment in simulators, models, training and — most important — your design data. It can even provide you with a smooth migration path from Verilog HDL to VHDL without jeopardizing your Verilog investment.

If your tools are facing extinction, Viewlogic can help you evolve a whole new world of possibilities. Call today.

To find out about our complete simulation solutions and more, call 1-800-873-8439 today or fax us at (508) 480-0882.

VIEWlogic®

THE REST IS HISTORY

All trademarks and registered trademarks are the property of their respective owners.

CIRCLE 232 FOR U.S. RESPONSE

CIRCLE 233 FOR RESPONSE OUTSIDE THE U.S.

UTP-5 cable.

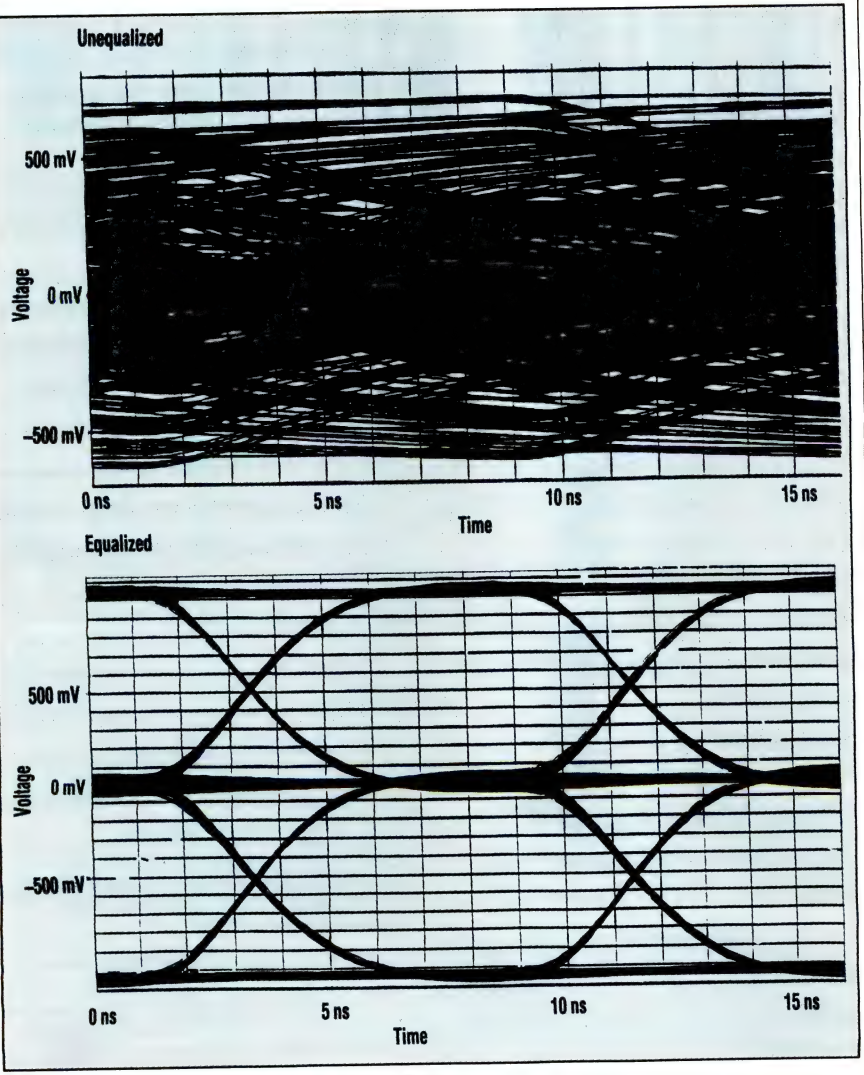
Following equalization, the signal is converted into NRZI code and fed through a loopback multiplexer onto the receiver output pins. These pins are connected to a physical-dependent receiver (PDR), such as the AM79C566 from Advanced Micro Devices Inc., Sunnyvale, Calif., for clock recovery.

The PDR output goes to an external FDDI controller chip, such as AMD's AM79C864 physical-layer controller. This device performs stream-cipher scrambling and descrambling of the NRZI signal—the third requirement for FDDI transmissions over twisted-pair wiring.

Scrambling is necessary to avoid energy peaks in the spectrum of the line signal. Such peaks can occur when a signal contains certain repetitive bit patterns that are allowed by the FDDI standard for fiber transmission.

To reduce peak frequencies, the scrambling process redistributes serial bits to average out the signal power spectrum and minimize EMI. Descrambling restores the bit stream to its original format. ANSI selected stream-cipher scrambling/descrambling over other techniques because its output spectral characteristics are independent of the input bit pattern.

In addition to the NRZI I/O pins, the ML6671 interfaces to external devices through a link-status circuit. This circuit provides a data-link indication. The link-detection threshold is fixed at 25% of the 100-meter cable-length setting of the equalization circuit. The received-signal level must be greater than this threshold to establish a link with the controller.



3. A SIMULATED EYE DIAGRAM for the ML6671's receiver output shows the benefits of the device's adaptive equalization (bottom). Without equalization, excessive distortion makes it impossible to extract valid signals (top). The distortion is due to the impedance of the telephone line, which acts like a low-pass filter. These plots, using MLT-3 coding, are for signals transmitted over 100 meters of twisted-pair wiring.

CONTINUITY CHECKS

With the addition of external circuitry, this circuit can also indicate if proper continuity exists between stations at either end of the media. For UTP-5 cables, this function isn't necessary. However, it can be useful for troubleshooting wiring errors and preventing a station from transmitting into an unterminated segment of cable.

When determining if an STP cable segment is connected in a loopback configuration (which is a default condition of an unterminated IBM MIC connector), the fault-detect function is recommended. This feature can prevent a station from tying up an FDDI controller by continually receiving its own transmitted data. The transceiver checks local continuity by looping back the transmitted data to the receiver output pins.

The ML6671 connects to the twisted-pair transmission line through a filter/magnetics module, such as the PE68502 designed by Pulse Engineering, San Diego, Calif. The module provides ac coupling, ground isolation, and common-mode filtering, which helps to minimize radiated emissions.

Fabricated in a 1.5-μm biCMOS process, the ML6671 FDII transceiver has internal differential signal paths to minimize the effects of power-supply transients and noise. The device operates from a 5-V power supply and is available in a 32-pin surface-mountable package.☐

PRICE AND AVAILABILITY

The ML6671 FDDI transceiver is available now for $20 each in quantities of 1000.

Micro Linear Corp., 2092 Concourse Dr., San Jose, CA 95131; David Wong, (408) 433-5200. **CIRCLE 525**

HOW VALUABLE?	CIRCLE
HIGHLY	584
MODERATELY	585
SLIGHTLY	586

WHO IS CREATING THE NEXT GENERATION OF HYBRID MODULES FOR CABLE TELEVISION?

The people who have already brought
110 channels into the world.

If you believe TV viewers have plenty of choice today, watch out tomorrow.

Community Antenna TV operators are poised to deliver more and more cable channels over the next decade. News and entertainment, home shopping, telephone and HDTV services will all be on the menu.

As a mass medium, it's still in its infancy. But already Philips has made a major contribution.

Our 750 MHz wideband hybrid module is the only production device that can deliver 110 channels down a CATV cable. And for the next generation,

Philips Semiconductors-USA: Riviera Beach, FL. Tel: +1-800 447 3762. Europe: Eindhoven, The Netherlands. Fax: +31 40 72482

Philips
Semiconductors

hilips is developing a 1 GHz CATV hybrid nodule capable of providing up to 150 channels.

Comprehensive application support and echnical documentation are other Philips pecialities. All backed up with the security of SO 9000-certified Quality Assurance systems in every Philips Semiconductors plant worldwide.

As one of the world's top ten semiconductor companies, Philips is ideally placed to develop new technologies and bring new products into the world.

It's a role we'll continue to play in the future.

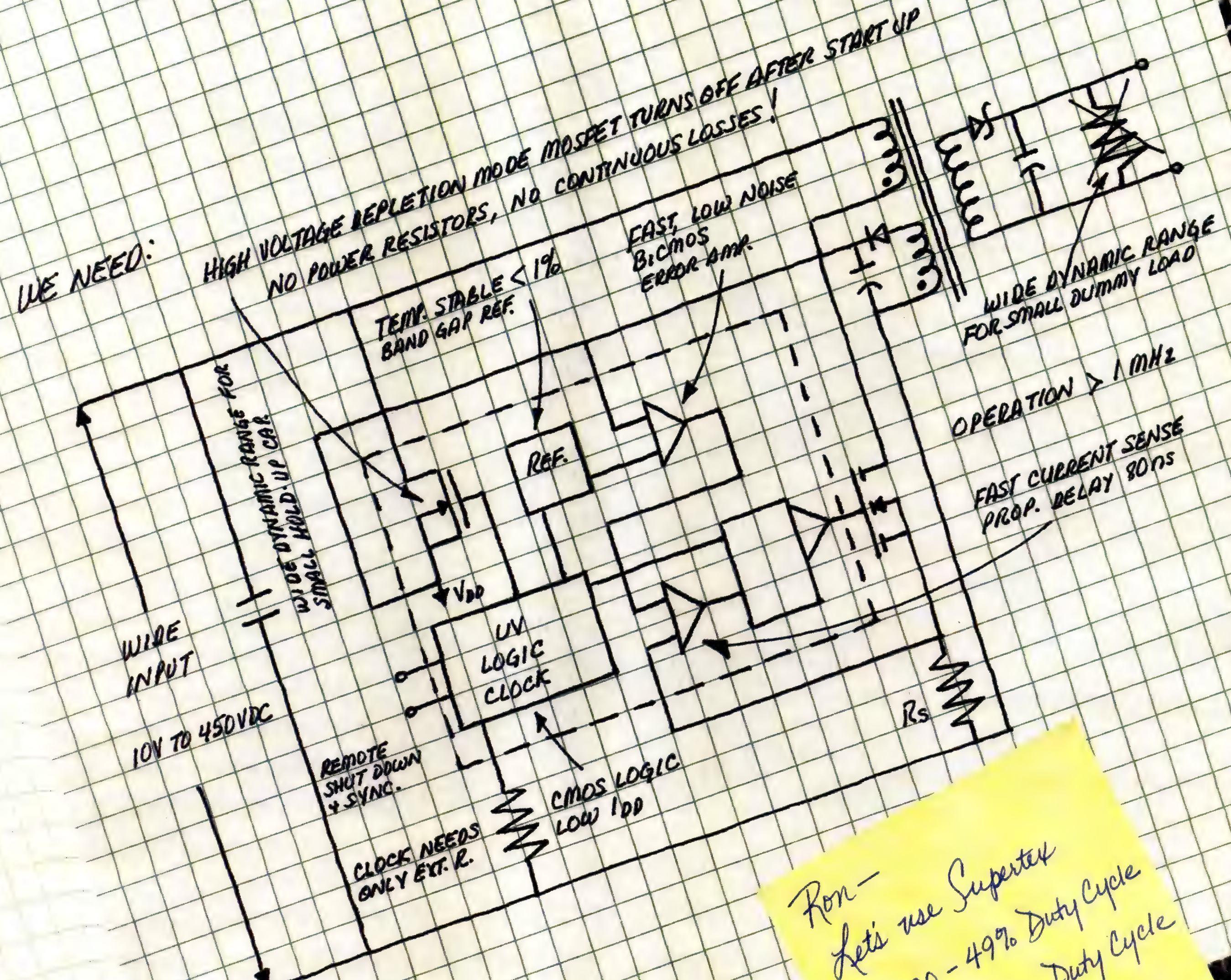
a-Pacific: Taipei, Taiwan. Fax: +886 (2) 500 5888.

PHILIPS

PHILIPS

CIRCLE 184

HIGH EFFICIENCY BiCMOS PWM ICs



Ron –
Let's use Supertex
HV9120 – 49% Duty Cycle
HV9123 – 99% Duty Cycle
Sandy

This is not wishful thinking.

Supertex high voltage BiCMOS technology makes all the above features possible in one monolithic IC. Our HV91 family products operate over a wide input voltage, allow compact and efficient designs with excellent line/load regulation.

For technical data and application information contact:

Supertex inc.
Leadership in CMOS/DMOS Technologies
1350 Bordeaux Drive, Sunnyvale CA 94089
Phone: (408) 744-0100 • Fax: (408) 734-5247

CIRCLE 216 FOR U.S. RESPONSE CIRCLE 217 FOR RESPONSE OUTSIDE THE U.S.

MASS STORAGE LOOKS FOR NEW SOLUTIONS

A Combination of Forces That Include Changing Storage Architectures and the Increased Use of Multimedia Will Foster More Innovation.

BY JACK SHANDLE

Over the next decade, the dominance of magnetic-storage technologies is likely to be eroded by competition from a variety of competitors. Some of the challengers, including optical and magneto-optical storage, are already in the marketplace. Others, such as holographic storage, are on the verge of being introduced. Furthermore, technologies like IBM's use of atomic-force microscopes to write and read data are in the early research phases and will require four or more years before commercialization could possibly proceed.

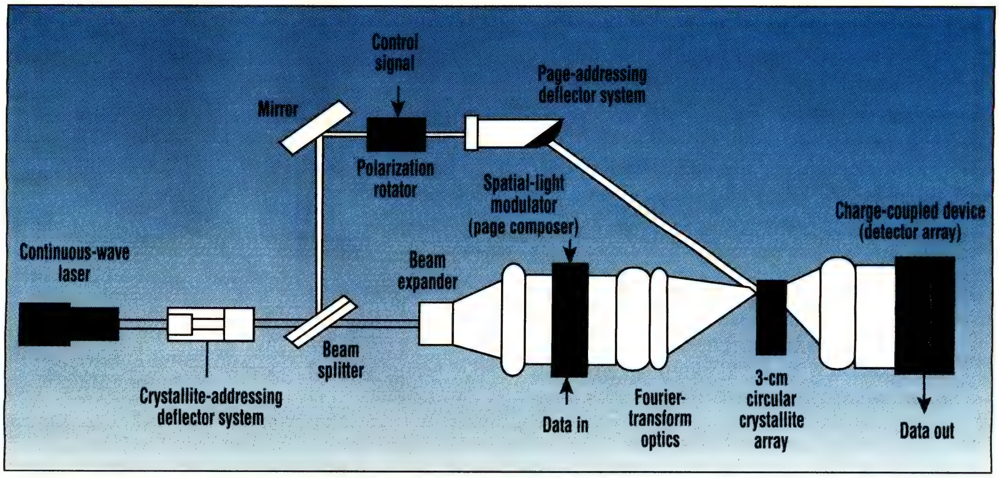
As has always been the case, magnetic storage will continue its impressive advances in both data density and speed. Although the mix of storage technologies may change significantly in the next few years, it's a good bet that magnetic storage will be around for a long time.

Just as important as the advances in basic technologies, however, is the environment in which they'll be used. Networks and new media types such as video will force a shift in how storage is used and accessed. Work at the National Storage Laboratory, Livermore, Calif., will someday introduce new paradigms for sharing a number of storage technologies on a network *(see "Livermore Lab seeks new mass-storage paradigm in networks," p. 94)*. Moreover, the advent of multimedia will make a strong case for storing media types, including video in native, digital formats *(see "Digital VCR for HDTV boasts 1.2-Gbit/s data rate," p. 100)*. Only time will tell how these new environmental forces will change the face of storage technology. But with the range of research underway, it seems likely that the industry will be up to the challenge.

HOLOGRAPHIC STORAGE

After years in research and development, volume-holographic storage is finally on the verge of commercialization. It promises to deliver storage densities 10 times greater than conventional magnetic or optical recording. It also guarantees data-access speeds and transfer rates that range between 10 and 1000 times faster than conventional systems. In this technology, data is recorded in photorefractive crystals as 3D holograms. Because all holograms provide the perception of 3D images, it's probably worthwhile to explain exactly what's meant by 3D in data-storage terms.

Binary data is written as dark or light "dots" in two-dimensional pages, with the pages stacked one on top of the other within a photosensitive crystal. The stacking of pages creates the third dimension. Strontium-barium-niobate crystals are used because they combine high sensitivity with high


Control signal
Page-addressing deflector system
Mirror
Polarization rotator
Spatial-light modulator (page composer)
Charge-coupled device (detector array)
Continuous-wave laser
Beam expander
Beam splitter
Crystallite-addressing deflector system
Data in
Fourier-transform optics
3-cm circular crystallite array
Data out

1. Volume holograms are generated using a 100-mW, green-light, yttrium-aluminum-garnet (YAG) laser that emits radiation at 532 nm at long coherence length. The laser beam is split into a reference beam and a data beam. The data beam passes through a page composer and then to a crystallite array. There it forms an electric charge pattern when it interferes with the reference beam.

speed. Electronic-charge patterns created by the interference of two laser beams is used to create the holograms *(Fig. 1)*.

In the most basic system, light from a laser source passes through a beam splitter that divides the beam into a data beam and a reference beam. The reference beam will eventually be used to create the interference pattern. It's directed into a path that includes a polarization rotor and a page-addressing deflection system.

The data beam, on the other hand, passes into an optical system that expands it onto the surface of a "page composer," which is implemented as a spatial-light modulator. Digital data is superimposed on the expanded beam using the spatial-light modulator. The images appear as dark or light spots, depending on the value of the digital data.

From the page composer, the data beam is converted using Fourier-transform optics. From there, it's focused on the crystallite structure that will hold the hologram. At this point, the data beam and reference beam come together again, with the resulting interference producing a unique grating pattern on a photorefractive material. This, in turn, modifies the optical properties of the crystallite material with an electronic-charge pattern.

The read cycle is a bit simpler. The data beam is turned off, allowing only the reference beam to focus on the crystal. The reference beam's location is determined by the particular pages to be read. The beam illuminates the interference grating stored at this location, resulting in the reconstruction of original light-and-dark-spots pattern. The pattern is read by a charge-coupled device that converts the dark and light spots back to digital electronic data.

The volume-holographic technology described in

LIVERMORE LAB SEEKS NEW MASS-STORAGE PARADIGM IN NETWORKS

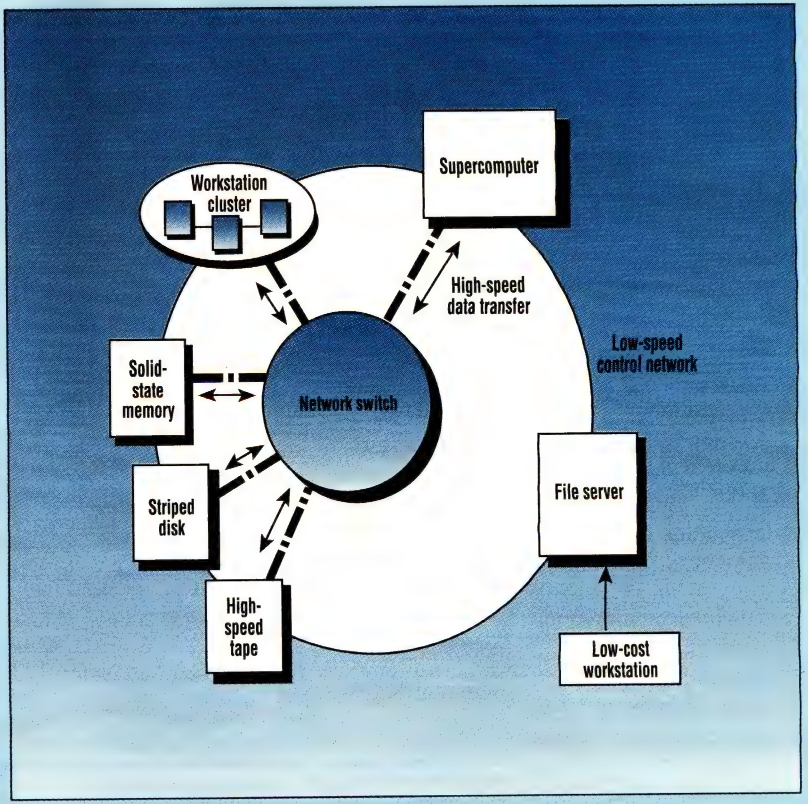
A new paradigm for managing and accessing mass storage is being developed and tested by a government/industry consortium called the National Storage Laboratory. It's headquartered at the Lawrence Livermore National Laboratory, Livermore, Calif.

While NSL's research focuses on breaking the storage bottlenecks encountered by high-performance systems, the technology is destined to trickle down to a much broader user community in the near future—particularly as storage-hungry data types such as video, audio and animation become more common. The new paradigm will include concepts like network-attached storage, multiple distributed storage hierarchies, and the integration of storage and data management, says Richard Watson, the NSL's project coordinator.

Conventional storage hierarchies have been single-pathway systems structured around a CPU. Typically, a mainframe computer acts as the file manager. Regardless of the mainframe's communications bandwidth, this architecture causes bottlenecks because all data and requests for data pass through a single point. The emerging network-attached architecture, on the other hand, puts a high-speed network switch at the center of the architecture. This switch-centric orientation means the data-management computer can access distributed-storage devices, servers, and clients over multiple data highways *(see the figure)*.

Although NSL's architecture is new in concept, it's being implemented with existing technologies and products. A HiPPI (High Performance Parallel Interface) switch is used to execute the high-speed transfers directly to and from CPUs on the network. An IBM RS/6000 workstation manages the transfers over a low-cost Ethernet local-area network.

High-bandwidth technologies such as Fiber Channel could be utilized in future prototypes to move both data and messages



this article originated at the Microelectronics and Computer Technology Corp. (MCC), Austin, Texas. It's capable of an average page-access time of 1 μs. Prototypes have used page sizes of 64 kbits with up to 50 pages per stack and up to 2000 stacks of pages per module. Using 3-by-3-by-0.5-cm crystals yields a capacity of 200 Mbytes. Write times are in the range of 100 μm and average sustained transfer rates have been estimated as high as 800 Mbytes/s.

MCC pioneered two breakthroughs, for which it received patents, that made the technology commercially viable. The first involves techniques that create small crystal arrays capable of storing more information than bulk crystal. The second is a nondestructive readout technique. Using multiple crystallites embedded in a supporting matrix makes the crystalline material easier and more economical to manufacture because it's difficult to grow larger crystals of acceptable optical quality. Moreover, the crystallite architecture minimizes crosstalk between stacks of pages. Each crystallite holds a separate stack of pages as opposed to pages being placed side-by-side in a large crystal. Still another advantage is that storage capacity is scalable: capacity is increased by adding more crystals to the array.

Just as important as the new crystallite material, however, is the non-destructive readout technology. The problem was that the read beam used to retrieve the information disturbed the equilibrium of the space-charge field and gradually erased the recording. MCC created a unique technology that creates just the right combination of static-electric fields in the crystal and just the right polarization of the laser beams to accomplish the non-destructive readout. Thus, it allows billions of read-write cycles to be performed.

MCC's work resulted in the formation of a new company, Tamarack Storage Devices Inc., Austin, Texas, which will commercialize the technology. "Our original product development is targeting mid-range applications, such as workstations, servers and personal computers," says Tamarack president John Stockton. Products may be available late this year or early in 1994—reportedly at about double the price of conventional technologies.

During the MCC-sponsored development phase, four companies developed specific components of the technology. Deltronic Crystal Industries Inc. worked on production methods for high-optical-quality strontium-barium-niobate crystals; Displaytech Inc. developed the integrated spatial-light modulator and the page composer; Hughes Technology Center contracted for the detector array used during the read cycle; and Amoco Laser Co., Naperville, Ill., developed the 100-mW, frequency-doubled, diode-pumped, solid-state, green-light laser. The yttrium-aluminum-garnet (YAG) laser emits radiation at 532 nm at long coherence length. The laser's coherence length is important for holographic storage because it allows a reproducible interference hologram to be created.

over the same communications link. Software is the technology that needs the attention. In NSL's prototype system, the data-management workstation runs NSL UniTree software, which acts as the database's librarian and traffic cop. The software was developed by IBM Corp.'s Federal Systems Division, Houston, Texas.

NSL UniTree is the first commercially available product to spin out of the NSL. It was developed by IBM under license from Discos Corp., San Diego, Calif. Discos offers an archival-storage-software package called UniTree that operates in a conventional mass-storage architecture.

The network-connected storage concept certainly isn't the be-all and end-all of the architecture. It's complemented by a distributed-storage hierarchy that includes solid-state memory, such as ferroelectric storage, striped disks, and high-speed tape. The hierarchy is based primarily on data-access and retrieval speeds.

One form of disk striping uses the emerging RAID (Redundant Array of Inexpensive Disks) technology and its corresponding products. In this scheme, the first byte of the file to be stored is put on one disk, the second byte on another disk, the third on still another, and so forth. When many disks are used, the file is accessed from them all simultaneously—much faster than if it all had to be accessed from one disk.

Helical-scan tape systems constitute another level of the hierarchy. They're used for archival storage and are implemented by the NSL using robotic storage silos. Data is moved from the tape cartridges to RAID arrays as needed. The concept of a "virtual disk" that's used to implement the hierarchy in software was developed by Cray Research Inc., Minneapolis, Minn. The fastest level in the storage hierarchy is solid-state memory.

Other companies represented in the NSL project include: Ampex Corp., Redwood City, Calif., which is supplying high-performance tape drives; Network Systems Inc., Minneapolis, Minn., which is providing network devices and interfaces; and Zitel Corp., Fremont, Calif., which is supplying high-speed, large-capacity solid-state memory. Other participating companies—Chi Systems, Pleasanton, Calif.; IGM Inc., Bellingham, Wash.; PsiTech Corp., Fountain Valley, Calif.; Maximum Strategy, San Jose, Calif.; and Kinesix, Houston, Texas—are providing other equipment and services that include software, high-performance interfaces, tape carousels, and monitors.

40 MFLOPS
220 MOPS
1541 dB
80 MBps
20 MIPS

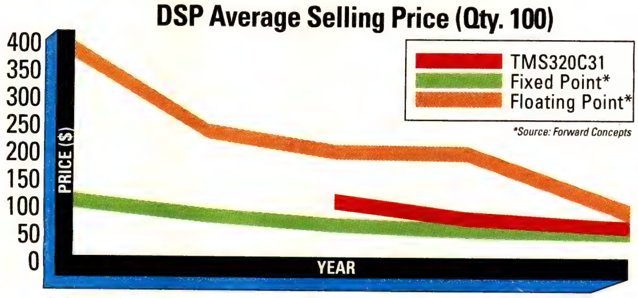
TI's floating-point DSPs. New design freedom you can afford.

Floating-point performance just became affordable. With the TMS320C31 digital signal processor (DSP) from Texas Instruments, you get floating-point performance at fixed-point prices. With suggested resale prices starting at just $25 for 100K units and just $49 for a single unit, the 'C31-27 is the cost-effective solution for your product differentiation needs.

Great performance. The TMS320C31 invites you to expand your design horizons. It delivers up to 40 MFLOPS and 20 MIPS with a 50-ns instruction cycle. It also features a high degree of on-chip parallelism that allows you to do up to 11 operations in a single instruction cycle — including, for example, two data accesses, a multiply, an ALU operation and a DMA transfer.

Fast to market. The TMS320C31 saves you valuable time in system development. The 'C31's floating-point capabilities provide more dynamic range and precision than fixed-point DSPs without the need to scale numbers. It features a register-based architecture, a software stack pointer and a 16-megaword address range for ease and flexibility. Its optimizing C compiler simplifies code debugging, benchmarking, porting and maintenance, using 'C3x-specific and general-purpose C optimizations. The PC and SPARC™ scan-based emulators allow the debugging of your target system in C language, assembly language or both, with the TMS320 C source debugger. And TI's evaluation module (EVM) features the same C source debugger for real-time evaluation and development — with a suggested resale price of just $995.

Total Integration means more. TI is committed to Total Integration™ — a concept that includes not only high-density chips but advanced development tools, technical assistance, comprehensive documentation and worldwide service and manufacturing support. Our customizable DSP capabilities allow you to integrate your own system logic with the 'C31 DSP core using standard ASIC tools. Choosing a TMS320 today puts you on the road to further integration tomorrow.



TI's TMS320C31 offers you floating-point performance at fixed-point prices.

Having it all. For more information on how to afford new design freedom with our 32-bit floating-point DSPs, call your local TI sales office.

EXTENDING YOUR REACH
WITH TOTAL INTEGRATION™

TEXAS INSTRUMENTS

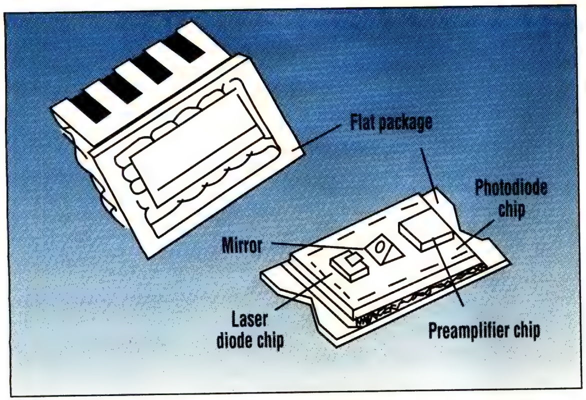
Australia & New Zealand: Sydney, 61-2-878-9000, fax 61-2-805-1186; Melbourne, 61-3-696-1211, fax 61-3-696-4446; Elizabeth, 61-8-255-2066, fax 61-8-255-2809. **Hong Kong:** 852-737-0338, fax 852-735-4954. **Korea:** 82-2-551-2800, fax 82-2-551-2828. **Malaysia:** 60-3-230-6001, fax 60-3-230-6605. **People's Republic of China:** 86-1-500-2255, ext. 3750, fax 86-1-500-2705. **Philippines:** 63-2-817-6031, fax 63-2-817-6096. **Singapore (& India, Indonesia, Thailand):** 65-350-8100, fax 65-253-6655. **Taiwan:** 886-2-713-9311, fax 886-2-716-9487.

© 1993 TI

00-7861B3ae

™ "Total Integration" and "Extending Your Reach With Total Integration" are trademarks of Texas Instruments Incorporated.
SPARC is a trademark of SPARC International.

CIRCLE 225

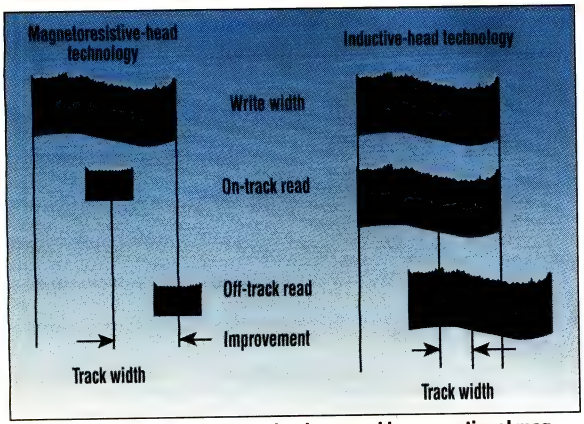


2. A laser diode chip, mirror, and preamplifier are mounted on the photodiode chip to make a compact optical-head technology. The preamplifier's electrodes are flip-chip bonded to the solder bumps of the photodiode chip. The photodiode and the package are bonded in the same manner.

Work on holographic storage is also underway at other laboratories, including IBM Corp.'s Almaden Research Center in Calif. In March, IBM reported it had developed a set of photorefractive polymer films that can record several erasable holograms in the same spot—something that previously was possible only with relatively expensive crystals, such as those being used in the MCC/Tamarack technology. Because the recording material is thicker than the light wavelength, several holograms can be stored in the same spot by tilting the data and reference laser beams slightly for each new hologram.

The film materials need an external electric field to align the polymer molecules when the hologram is being written or read. When the field is turned off, the hologram isn't erased. It reappears when the field is turned back on.

According to IBM, polymers have several advantages over crystals in storage applications: they will almost undoubtedly be much cheaper to manufacture; can be formed into useful shapes such as thin films, coatings, and waveguides; and their chemical composition can be varied to obtain special characteristics.



3. Compared to the inductive technology used in conventional magnetic read/write heads, magneto-resistive technology offers a smaller read-head width. This makes the recovery of slightly off-track data more likely.

As promising as volume-holographic storage is, however, it's a well-established rule in engineering that existing technologies of any type are always a moving target for the newcomer. That rule certainly applies to storage technologies.

Blue-light laser research at IBM's Almaden Research Center, for example, is expected to eventually push the capacity of rotating optical storage to a bit density of 2.6 billion bits/in.^{2}. Simply stated, the higher-frequency blue light (it has a wavelength of 429 nm) can be focused on a much-smaller spot than the infrared light now used in CD-ROM and rewritable optical-disk technologies.

IBM's blue-laser technology has been integrated into a system that includes a four-element objective lens with a numerical aperture (NA) of 0.65. The lens focuses the 429-nm beam on a spot less than 0.4-µm wide. Some of the system components, including the photodiode detectors and the silicon servo detectors, are optimized for 830-nm lasers and have a low sensitivity at the blue-light laser's 429-nm wavelength.

Developing and manufacturing new components to accommodate the lower wavelength is one task at hand for IBM over the next four or five years in order to develop products from the technology. At the densities envisioned by the company, however, a standard 5.25-in.-diameter CD-ROM could hold 6.5 Gbytes instead of its current 670 Mbytes.

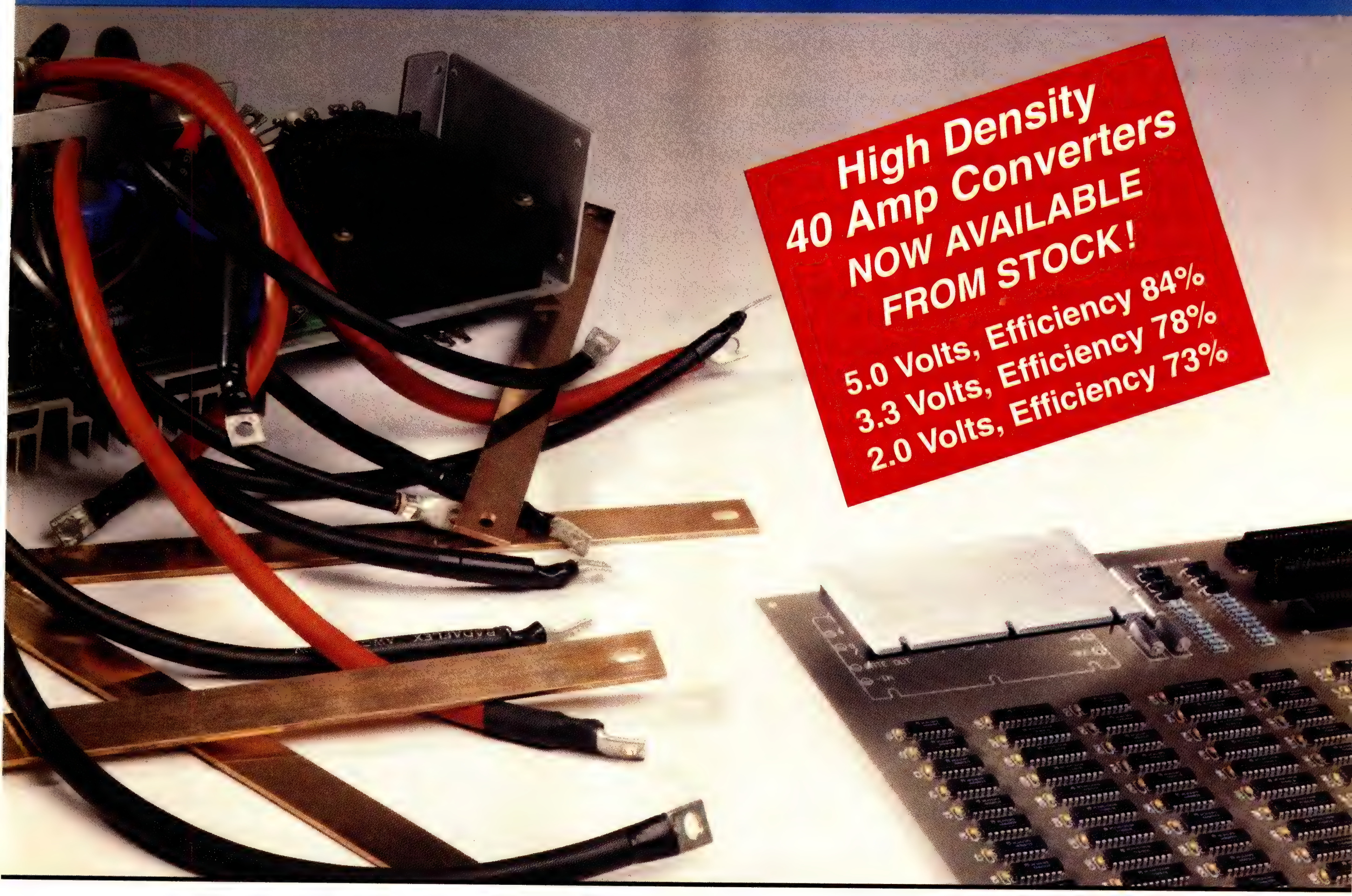
OPTICAL-DISK STORAGE

Optical read/write head designers also have been toiling away. Progress made on a more compact head for CD-ROM drives by NEC Corp.'s Opto-Electronics Research Laboratory, Kawasaki, Japan, has led to a highly innovative prototype. Compactness and light weight are crucial elements in improving access speed simply because they determine how fast the read/write head and its carrier are to be positioned.

Compactness usually means higher levels of integration. Using flip-chip technology, NEC's recent innovation combines all of the head's optical components into a single package. In conventional optical heads, only the lens is moved by the actuator; all other elements are fixed to an optical base. This design mounts every element on a holder. Besides the obvious advantages afforded by compactness, the fact that all of the elements are moving as one on the holder prevents tracking errors caused by signal offset that can be traced to movement of the lens. A laser diode chip, mirror, and preamplifier are mounted on the photodiode chip *(Fig. 2)*. The preamplifier's electrodes are flip-chip bonded to the solder bumps of the photodiode chip. The photodiode and the package are bonded the same way.

Flip-chip bonding eliminates the space occupied by bonding wires and reduces stray capacitance and inductance. Besides the performance benefits, this results in an extremely compact optical head that's only 6.9 mm thick (including working dis-

ower Distribution vs. Distributed POWER


High Density
40 Amp Converters
NOW AVAILABLE
FROM STOCK!
5.0 Volts, Efficiency 84%
3.3 Volts, Efficiency 78%
2.0 Volts, Efficiency 73%

High Density Power Components...
The Logical Solution For Digital Systems

h operating voltages trending lower, contemporary ctronic systems can gobble up lots of current. And at ay's higher currents, old-fashioned bulk power distribution emes only give you more of what you don't need...losses, ght, cost and field failures...noise and signal interfacing blems...wasted space.

gh Efficiency • High Density • Higher Current

VI-200 family of DC-DC converters lets you put power ere you need it...right at the load. And now we're delivering o 33% more power...40 Amps...at 5.0, 3.3 and 2.0 Volts. re also delivering unmatched levels of efficiency, for the e price and in the compact package that's the standard for industry.

Concerned about reliability? These babies have impeccable genetics. After all, they're the newest members of the VI-200 family...a family whose field longevity has been proven in an installed base of over 1.5 million units.

Tired of using the bus? If you'd like to bring a better solution on-board, call Vicor.

CIRCLE 274 FOR U.S. RESPONSE

CIRCLE 275 FOR RESPONSE OUTSIDE THE U.S.

Component Solutions For Your Power System

VICOR

r Corporation • 23 Frontage Rd., Andover, MA. 01810 USA • TEL: (508) 470-2900 • FAX: (508) 475-6715
or GmbH • Tel: +49-89-329-2763 • Fax: +49-89-329-2767 • **Vicor Far East** • Tel: +886-2-9188240 • Fax: +886-2-9132982

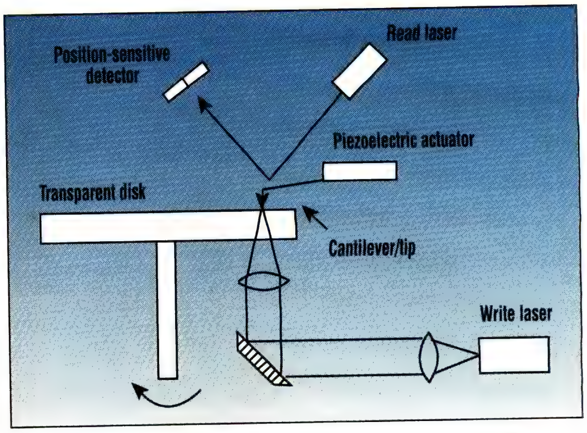
tance), 6 mm wide, 6 mm deep, and 1.64 mm high. The head weighs just 0.25 g.

As is always the case in optical storage, massive research efforts continue to be expended in laser development. For instance, rewritable optical-disk systems could benefit from work at NEC's Opto-Electronic Research Laboratories on high-power strained quantum-well aluminum-gallium-indium-phosphide (AlGaInP) lasers.

One advantage of AlGaInP lasers is that their spot size is more than 30% smaller than conventional AlGaAs lasers. This reduction is due to a shorter lasing wavelength, which in NEC's technology is 690 nm. Reducing spot size is effective because the smaller spot results in a 1.5-times increase in recording density for optical-disk memories.

The disadvantage of AlGaInP lasers has been that they typically have one-third the power output of AlGaAs lasers. A practical optical-disk system, on the other hand, requires at least 30 mW. Attempts to fabricate high-power AlGaInP lasers have been successful—60 to 70 mW was achieved. But researchers continue to be frustrated by the fact that long-term stable operation at 50°C has limited output power to 20 mW. In essence, the researchers added a strained quantum-well layer to one of the high-power AlGaInP lasers and improved output power to 40 mW at 80°C. The lasers have demonstrated 30-mW stable operation at 50°C for over 2600 hours.

Toshiba Corp., Tokyo, Japan, also developed at 690-nm, 30-mW laser. The company integrated the laser into a prototype system that includes a high-speed circuit for controlling the laser's power. The system records data at a pitch of 1.25 μm, and also can overwrite the data. Toshiba claims this combination of technologies paves the way to doubling data densities and perhaps reaching 70 Mbytes/in.[2], which is a more optimistic estimate than NEC's..



4. A system that heats the tip of an atomic-force microscope with a laser to mark a polycarbonate substrate could someday form the basis of a very-high-density storage technology. The marks are typically about 100 nm across and 10 to 20 nm deep.

Besides innovations on the read/write aspects of the system, Toshiba also experimented with a disk material that's based on the phase-change phenomenon. A phase-change medium utilizes the crystallization of amorphous metal so that the laser beam can read and overwrite data. The particular medium was GeTbSb (germanium-terbium-antimony) with a thickness optimized for visible laser light.

One of the problems for phase-change media is that laser-power stability is critical. Toshiba's fast laser-power control circuit suppresses this laser noise and reduces interference radiation. As a result, carrier-to-noise ratio was 56 dB. Although a doubling of storage density is theoretically possi-

DIGITAL VCR FOR HDTV BOASTS 1.2 GBIT/S DATA RATE

Digital storage technologies have always strived to be faster and denser than the previous generation. That trend is bound to continue, but there's also a burgeoning need to take new data formats into account.

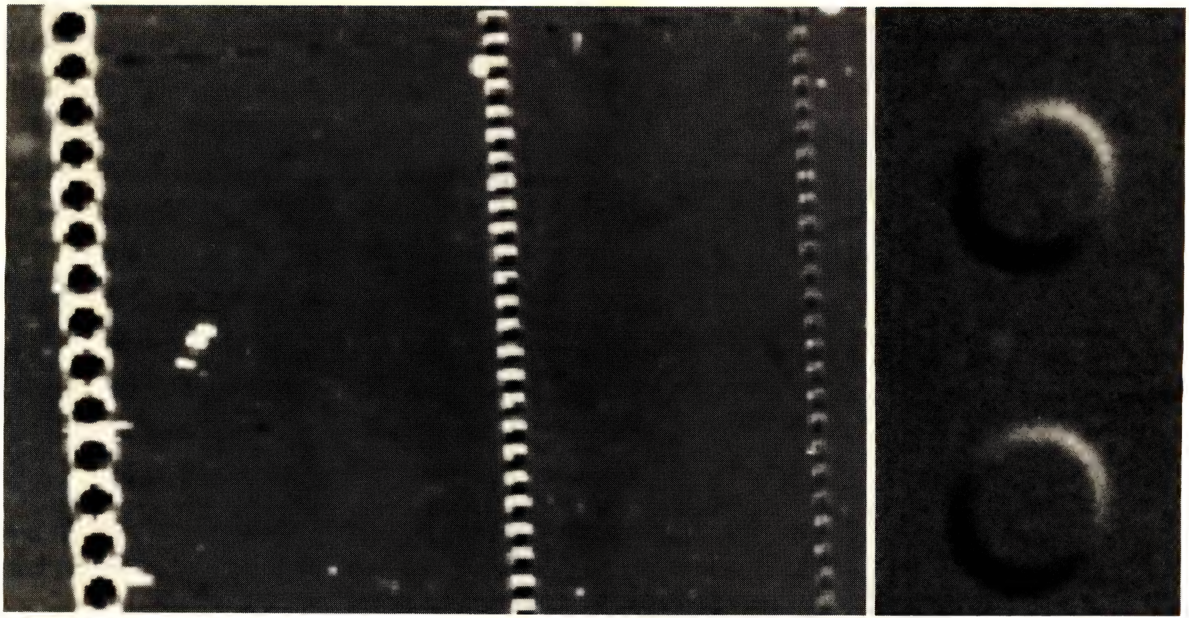
In particular, media types such as video previously haven't been factored into the mass-storage equation because video was analog, not digital, and there were only very specific instances when anyone would want to access it using a computer. Multimedia may well change those assumptions, which makes it possible to predict that VCRs for high-definition TV might someday be included in some file-server architectures.

A digital VCR that can handle the 1.2-Gbit/s data rates of HDTV is one of the research projects underway at Toshiba Corp.'s Research Center, Kawasaki, Japan. A prototype system has been built that stores slightly more than one hour of video and audio using 3/4-in. tapes instead of the 1-in. format employed in existing digital VCRs for HDTV. Recording density is about 6.3 μm^2/bit, which is about twice the recording density of 1-in., open-reel, high-definition VTR tapes.

To record and playback at a rate of 148.5 Mbit/s on each of eight channels, the record/playback amplifiers—one set of two for each eight channels—should be mounted as closely as possible to the recording drum. Otherwise, the parasitic capacitances would corrupt the signal. Toshiba designed two new low-noise, low-power analog ICs, one for recording and the other for playback.

In addition, a stable transport mechanism was developed to ensure reliability because digital-cassette recording requires faster drum rotation than conventional analog VCRs.

The design includes wider grooves on the drum's surface. These grooves are used to absorb the air between the tape and drum. The system can reliably drive a magnetic tape thinner than 13 μm at a rate of 466 mm/s. The head-to-tape scanning speed is as high as 48 m/s.



5. Experimental results using the tip of an atomic-force microscope to mark bits show, on the left, three tracks written at slightly different frequencies. The marks were written with 1-μs laser pulses with a 50-100 kHz repetition rate while the sample was moving at 25 mm/s. The photograph on the right shows a a blowup shows one section of track. The pits are approximately 150 nm across and 15 nm deep.

ble, the prototype system falls short. A 20% improvement in linear recording density was achieved compared to the 830-nm laser in use today.

At the corporate laboratories of Sanyo Electric Co. Ltd., Osaka, Japan, researchers have also been working on quantum-well phenomena to boost performance. But whereas NEC focused its attention on an AlGaInP 690-nm laser, Sanyo's work was on 636-nm AlGaInP laser technology. A tensile-strained multi-quantum-well layer was introduced into the laser's active layer to provide higher performance. Stable prototypes have operated at 40°C producing 20 mW for more than 1500 hours.

Sanyo has also experimented with new magneto-optic media that would extend the disk's usable life. Unlike rewritable disk drives based on phase-change phenomena, which use the laser's power to crystallize the recording medium, magneto-optic technology employs laser power to change magnetic characteristics.

Sanyo's prototype disk uses a substrate of 1.2-μm-thick polycarbonate, that is pre-grooved with a 1.6-μm pitch. An 800-Å-thick layer of zinc oxide acts as an optical enhancement layer. Nine layers of platinum/cobalt bilayer films were added on top with each platinum layer being 17-Å thick and each cobalt layer being 5-Å thick. A 10-μm UV resin protective layer was formed on top of the disk as the final step.

Accelerated testing for 2000 hours at 80°C scarcely reduced the carrier-to-noise ratio, but the block error rate increased because of noise produced by local defects. The estimated life of the disk at room temperature is more than 10 years.

IBM, always a leader in magnetic-storage technologies, is developing even more advanced MR read-write head technologies than what's presently available on the market. Areal densities for magnetic storage, now in the vicinity of 0.1 Gbyte/in.^{2}, are projected to be at 1 Gbyte/in.^{2} by 1995.

MAGNETIC-STORAGE ADVANCES

IBM's basic design for an MR head consists of separate read and write structures formed over each other and sharing a few common elements. The two elements can then be optimized separately for maximum areal data density.

The write structure is a thin-film inductive head. Fewer copper coil layers are needed in this type of design compared to inductive heads that provide both read and write functionality. There are also fewer photolithographic masking steps.

The read structure, on the other hand, consists of an alloy film that exhibits a change in resistance in the presence of magnetic fields. A precision sense-amplifier circuit detects changes in the magnetic field and produces a signal for the disk-drive channel. Although the write width of the MR technology is the same as inductive technology, the MR-head read width is smaller *(Fig. 3)*. These dimensions provide an improved error rate when the head reads at an off-track position, and allows for a significant increase in areal density.

While MR technology is being pushed to provide greater data density, research at Fujitsu Laboratories Inc., Atsugi, Japan, promises to improve MR-based hard-disk-drive data-transfer performance. So far, the research has produced a smaller assembly for the system that holds the head over the disk. This integrated suspension system has a miniaturized, flexible body and no signal wires. Instead of wires, the new system prints lines directly on the suspension arm's surface.

A redesigned gimbal that consists of a pair of T-shaped beams is one key to miniaturization. The beams are connected to the load beam at both to

Come See People From Other Worlds.

They come from analog. They come from digital. And when you come to the Analog Devices Total System Design Seminar, you'll meet them. They're some of the brightest stars in the industry and now that components are growing more complicated by the day, their mission is to bring system design down to earth.

Prepare to have an encounter of the most useful kind. Starting October 5th, you'll be *experiencing* the latest techniques in precision and high speed as well as audio applications. Techniques that will not only help you increase system performance, but actually lower overall cost. Sound out of this world? Fact is, it couldn't be easier. Just sign up for one of the all-day Total System Design Seminars hosted by Analog Devices, one of the world's leading suppliers of analog and mixed-signal ICs.

When you do, for a mere $30 you'll also encounter lunch, refreshments, an 870-page "Systems Application Guide" and a galaxy of extras. To make contact, get more information, or to charge your ticket, call 1-800-ANALOG-D (in Canada, call 617-937-1430). After all, times being what they are, can you really afford to let total system design be alien to you?

ANALOG DEVICES

For reservations or more information write Analog Devices, Total System Design Seminar, 181 Ballardvale Street, Wilmington, MA 01887.

CIRCLE 268 FOR U.S. RESPONSE CIRCLE 269 FOR RESPONSE OUTSIDE THE U.S.

keep the system's resonant frequency high despite the gimbal's lightness and increased flexibility. The integrated suspension system is 25-μm thick, 10-mm long, 4-mm wide, and the beam width of the gimbal is about 200 μm. Its total weight is about one-third the weight of devices now used in high-end commercial products.

A test with an MR-head transducer and a nanoslider attached to the suspension system indicated that the system's resonant frequency exceeds 50 MHz. This makes it possible to transfer data at rates over 10 Mbytes/s.

IBM researchers have high hopes of pushing MR-head performance to even higher levels with new materials. MR-sensing technology is based on the change in resistance caused by magnetic fields. Typically, these changes aren't great. IBM's most advanced commercial drives, for example, use thin films of iron-nickel alloy, which has an MR effect of less than 2%. But Almaden researchers found that by alternating layers of magnetic and nonmagnetic materials, such as cobalt and copper, they can achieve MR effects as high as 65% in the presence of very high magnetic fields.

The vast change in MR effect led the researchers to coin the term giant magneto-resistance, or GMR. We will be hearing more about GMR in the future, but it won't appear in commercial products until some problems are solved. The field strengths—10,000 oersteds in the case of the copper/cobalt layers that exhibit a 65% MR effect—are just too high to be practical for disk drives. In a 20-Oe field, the copper/cobalt layers show an 8% MR effect. Unfortunately, though, cobalt's magnetic properties aren't suitable for a practical sensor, so the search for a suitable materials combination continues.

One possible solution may blossom from the practice of interposing a buffer layer between the magnetic and nonmagnetic layers. Buffered-GMR work is going on in several laboratories, one of which is a cooperative research effort between materials scientists at Stanford University and Fujitsu Ltd. They've found a promising technology by sputtering $Co_{90}Fe_{10}$ buffer layers in different depths. Among the research findings from the project is the fact that GMR is not sensitive to the degree of orientation of the magnetic and non-magnetic films is not critical. In addition, the increase GMR effect in the filims with thin Cu spacers results from the reduced interface roughness and improved superlattice structure in the films.

ADVANCED TECHNOLOGIES

Although most of the research into storage technology is focused on modifying existing technologies to extend their performance, corporate and university laboratories continue to investigate and develop new technologies.

A large research effort is going on, for example, in ferroelectric memories. Although this technology is not frequently thought of as a candidate for

The Analog Devices Total System Design Seminars

North American
Locations & Dates

Rochester, NY October 5
Ottawa, ON, Canada October 6
Toronto, ON, Canada October 7
Chicago, IL October 8
Duluth, GA October 12
Beaverton, OR October 12
Huntsville, AL October 13
Bellevue, WA October 13
Columbia, MD October 14
Milpitas, CA October 14
Manhattan Beach, CA October 15
Tampa, FL October 15
Woodland Hills, CA October 19
Waterbury, CT October 19
Mahwah, NJ October 20
Irvine, CA October 20
San Diego, CA October 21
Mt. Laurel, NJ October 21
Phoenix, AZ October 22
Plymouth Meeting, PA October 22
Burlington, MA October 28
Detroit, MI November 2
Lancaster, PA November 3
Research Triangle Pk., NC November 4
State College, PA November 4
Newton, MA November 5
Denver, CO November 8
Milpitas, CA November 9
Minneapolis, MN November 10
Cleveland, OH November 11
Falls Church, VA November 12
Richardson, TX November 16
Houston, TX November 17
Merrimac, NH November 19
Cedar Rapids, IA November 30
Milwaukee, WI December 1
Indianapolis, IN December 2
St. Louis, MO December 3
Ft. Lauderdale, FL December 7
Orlando, FL December 8
Kansas City, MO December 15
Austin, TX December 16
Kansas City, KS December 17

ANALOG
DEVICES

ATTENTION MARKETERS!

REACH DESIGN & DEVELOPMENT ENGINEERS

ELECTRONIC DESIGN subscribers are highly educated engineers and managers in the electronics original equipment market.

Select by job function, type of industry, purchasing influence, employment size, and geography.

●

Guaranteed
99% Deliverable
100% BPA Audited.

Call your Advertising Representative, or call **(216) 696-7000**, and ask for the List Department. Request your FREE Penton Lists Catalog!

Penton Lists

storage, its nonvolatile characteristic could deliver on that promise. One problem has been to develop a nondestructive readout technique. Right now, every time the memory is read, it has to be rewritten to its original state and a brief period of destructive readout takes place. If the system is disturbed during this tenth of a nanosecond, the information can be scrambled. Sandia National Laboratory and Radiant Technologies, Albuquerque, N.M., are developing a nondestructive memory by adding a semiconductor thin film above the ferroelectric thin-film layer. In the proposed device, the conductivity of the semiconductor thin film is modulated by the polarization of the ferroelectric layer. By modulating the current this way, a direct, nondestructive readout can be accomplished.

In other advanced work, the primary idea is to make the size of the recorded information as small as possible. Even a bit cell that's several hundred angstroms on a side, for example, would provide higher densities than are now attainable. IBM, for example, is looking into the possible use of an atomic-force microscope (AFM) and an infrared laser to create a pit in the recording medium that's anywhere from a few hundred angstroms to 1 μm in size, depending on the size of the laser pulse and the loading force on the tip. The pulses can be as short as 0.3 μs. By operating this system on a rotating disk, IBM's Almaden researchers have demonstrated that features can be written and read at frequencies up to 100 kHz.

The technique uses a modulated laser beam to heat the AFM tip and deform a polymer substrate at high speed *(Fig. 4)*. A 30-mW, 830-nm-wavelength laser with a 0.545 NA was selected. The AFM tip sits in contact with a 1.2-mm-thick polymethyl methacrylate substrate that has a static-controlled load. The diode laser is focused on the tip, which is coated with a layer of gold (a few hundred angstroms thick) that acts as an energy-absorbing material. When the laser is pulsed, the tip heats up to about 120°C and softens the media. Pressure from the tip forms the mark. Typically, the research version of a prototype operates at about 10^{-9} newtons, which results in marks about 100 nm across and 10 to 20 nm deep *(Fig. 5)*.

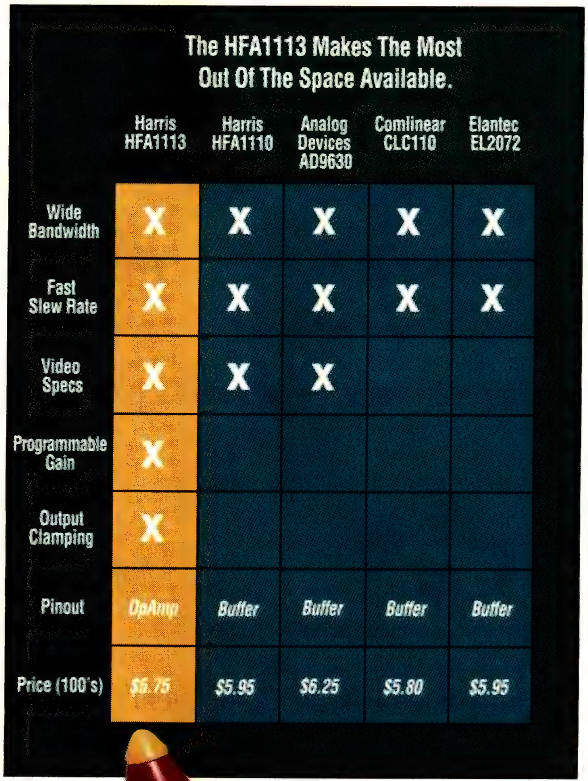
To verify that the writing could take place while the medium was moving at reasonable speed (on the order of 100 mm/s), the researchers attached the sample to the shaft of a precision air-bearing spindle. With the disk spinning at a modest 1 Hz, the linear velocity was about 60 mm/s. In this first attempt, the system was able to write at a repetition rate of 100 kHz. IBM believes data rates in the low megahertz are attainable.☐

HOW VALUABLE?	CIRCLE
HIGHLY	526
MODERATELY	527
SLIGHTLY	528

THE MOST SPACE EFFICIENT VIDEO BUFFER IN THE GALAXY.

AT $5.75 IT'S ALSO THE MOST COST-EFFICIENT.

Conquer space and time with the new HFA1113 video buffer, the fastest (850MHz -3dB bandwidth) and most space-efficient buffer you can get. Free up board space with built-in output clamps and gain programming. Warp into production sooner with a standard op amp pinout that lets you drop it into an existing socket. And since the HFA1113 is priced at $5.75, you can go on to conquer another dimension: your budget. You just can't afford not to have one of these amazing devices in your video rack.

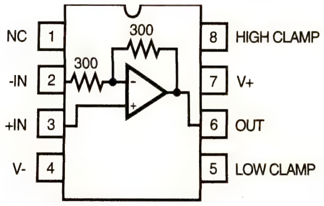


The HFA1113 Makes The Most Out Of The Space Available.

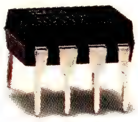
	Harris HFA1113	Harris HFA1110	Analog Devices AD9630	Comlinear CLC110	Elantec EL2072
Wide Bandwidth	X	X	X	X	X
Fast Slew Rate	X	X	X	X	X
Video Specs	X	X	X		
Programmable Gain	X				
Output Clamping	X				
Pinout	*OpAmp*	*Buffer*	*Buffer*	*Buffer*	*Buffer*
Price (100's)	*$5.75*	*$5.95*	*$6.25*	*$5.80*	*$5.95*

HFA1113 Features

- Excellent gain flatness and differential phase and gain
- 850MHz -3dB bandwidth
- Programmable gain (+2, ±1) eliminates external resistors



- Programmable output clamps eliminate external diodes
- <1 ns recovery time
- 60mA output current
- 8-pin PDIP, SOIC and CERDIP packages
- Just $5.75 (100s)



For a more space-efficient design, you'll have to go back forty years.
The Captain Video Survival Ring packed a compass, magnifying glass, rubber raft, and two weeks' supply of food into a module that would fit your pinkie.
Today, the HFA1113 will get you out of just as many tight spots.
And you won't have to send in a single box top.

HARRIS SEMICONDUCTOR ANSWER FAX

Try our new AnswerFax service!
For a data sheet call 407-724-3818 and request document #1342.
Or call 1-800-4-HARRIS, ext. 7116 for a free brochure.

HARRIS SEMICONDUCTOR

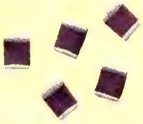
CIRCLE 316 FOR U.S. RESPONSE CIRCLE 317 FOR RESPONSE OUTSIDE THE U.S.

IF YOU WANT TO KNOW WHO MAKES THE M

AVX MLC CAPACITORS

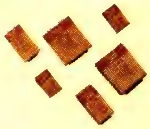
Y5V Dielectric MLC Caps

0402 MLC Caps



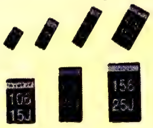
Low Profile MLC Caps

No matter what you're looking for in surface mount passives, chances are you'll find it at AVX. That's becaus



TAJ Low Profile Ta Caps

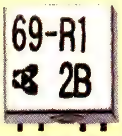
HRC 5000 High-Reliability Ta Caps



CWR09 Ta Caps

TPS Low ESR Ta Caps for Power Supplies

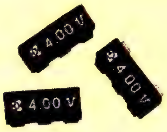
plus a full range of timing devices, filters and resistors. Yet quantity isn't all we have to show for ourselves



EK Series-Voltage Controlled Oscillator

KTS Series-Temperature Compensated Crystal Oscillator

KS Series-Crystal



PBRC Series-MHz Resonators

new Y5V dielectric for higher capacitance in a smaller package. A complete line of low-profile Ta chips includin

AVX TRIMMERS

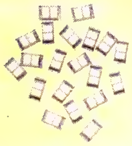
CTZ Series-Trimmer Capacitors

CVR Series-Trimmer Potentiometers

AVX RESISTIVE PRODUCTS

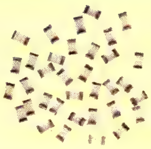
such AVX "firsts" as our advanced Integrated Passive Component (IPC) for unmatched reliability in a custom

TransGuard® Transient Suppressors



Accu-Guard Fuses

SupraCap® MLC Cap for Power Supplies



Accu-F® High-Frequency Caps

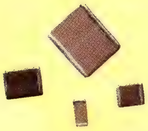
nearly inexhaustible supply of SMDs, simply call us at 803-448-9411. Or contact your nearest AVX representative

Ask the World of Us.

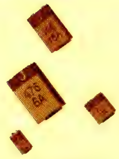
Some products not shown to scale.

ST SMDs, JUST READ BETWEEN THE LINES.

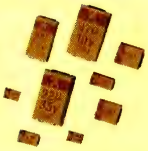
Low Inductance MLC Caps


CDR MLC Caps

AVX TANTALUM CAPACITORS

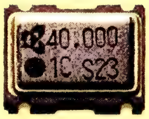

CWR11 Ta Caps

e offer the industry's broadest possible line—everything from MLCs to Ta chips to transient protection,


TAJ Molded Ta Caps

AVX TIMING DEVICES

AMO Series-Clock Oscillator

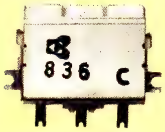


K50 Series-Clock Oscillator

VX also makes some of today's most advanced SMDs. Like our 0402 chip, the world's smallest MLC. Our

KBR-Y Series-KHz Resonator

AVX FILTERS



KDF Series-Dielectric Filter

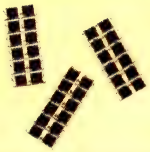
PBF Series-Bulk Filter

Ta Power Supply (TPS) capacitor that's ideal for laptop and DC/DC converter applications. Not to mention

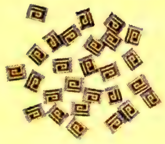
CRA Series-Chip Resistor Arrays

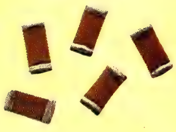
CR Series-Chip Resistors

AVX ADVANCED PRODUCTS

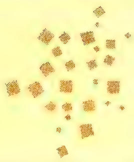

Integrated Passive Components

w-profile chip. Or the 1206 Accu-Guard, the industry's only thin-film SMT fuse. To learn more about AVX's


Accu-L Inductors


High-Temperature MLC Caps

High-Voltage MLC Caps


MAXI-SLC High-Frequency Caps

ou'll discover nobody has a better read on exactly what you're looking for in SMDs.

AVX CORPORATION
A KYOCERA GROUP COMPANY

CIRCLE 359 FOR U.S. RESPONSE

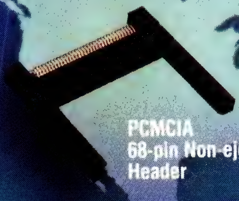
CIRCLE 360 FOR RESPONSE OUTSIDE THE U.S.

BERG MEMORY CARD SYSTEMS...

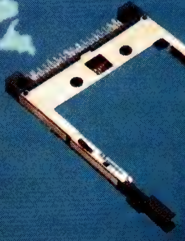
THE FIRST

TRUE CONNECTOR-TYPE MEMORY CARD
BERG, JAPAN, 1984

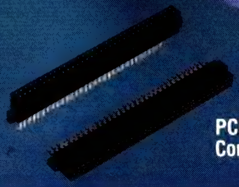
PCMCIA CARDS



PCMCIA 68-pin Non-eject Header

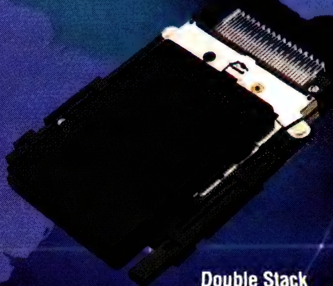


PCMCIA Eject Headers For Type I, Type II, Type III Cards



PCMCIA Receptacle Connectors

Type II I/O Card Case Component Kit



Double Stack Eject Header with Type III Card

THE MOST

BECAUSE YOUR FIRST DESIGN MAY NOT BE THE ONE YOU WIND UP WITH

THE LATEST

BECAUSE EVERYONE WANTS TO BE THE FIRST

BERG
ELECTRONICS
Formerly DuPont Connector Systems

CERTIFIED ISO 9001 WORLDWIDE

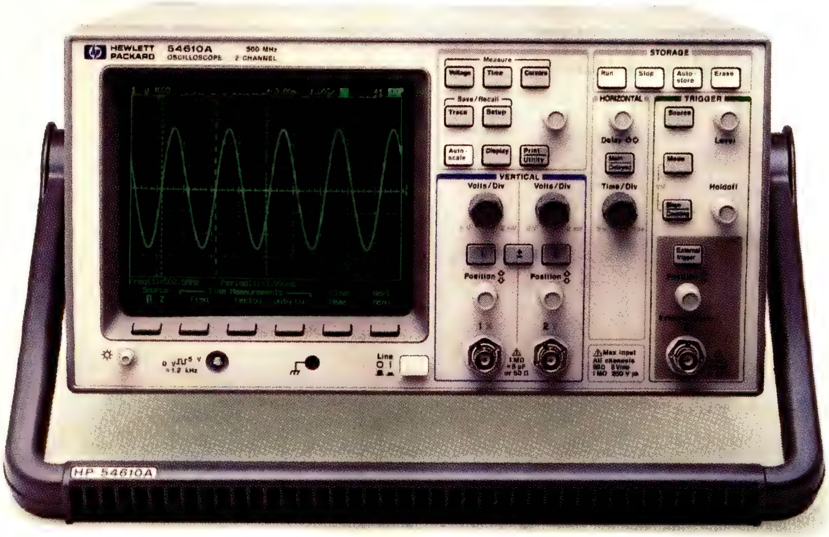
CALL US ANYWHERE IN THE WORLD YOU CHOOSE TO WORK.

HERTOGENBOSCH, NETHERLANDS: Phone: +31 73 206 259; FAX: +31 73 21 4439 • LES ULIS CEDEX A, FRANCE: Phone: +33 81 54 54 54; FAX: + 33 81 52 0411 • BAD HOMBURG, GERMANY: Phone: +49 61 7287 18 09; FAX: +49 61 72 8718 40 • HITCHIN HERTS, UNITED KINGDOM: Phone: +44 462 44 1555; FAX: +44 462 441 600 • TOKYO, JAPAN: Phone: +81 03 54935200; FAX: +81 03 54935233 • KYUNGGI-DO, KOREA: Phone: +82 336 301265; FAX: +82 336 301117 • NGEE ANN CITY, SINGAPORE: Phone: +65 7388277; FAX: +65 7384122 • KOWLOON, HONG KONG: Phone: +852 7212220; FAX: +852 7230787 • TAOYUAN, TAIWAN: Phone: +886 03 4549173; FAX: +886 03 4620676 • MADURAI, INDIA: Phone: +91 452 44520; FAX: +91 452 37587 • MISSISSAUGA, CANADA: Phone: 800 263 5963; FAX: 416 821 5659 • ETTERS, PA, USA: Phone: 717 938 6711; FAX: 717 938 7000. **See Us At Wescon, Booths 2364, 2366.**

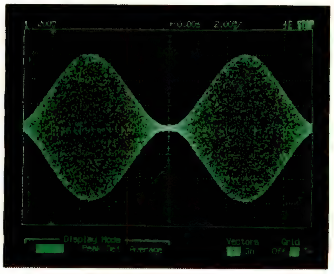
CIRCLE 320 FOR U.S. RESPONSE

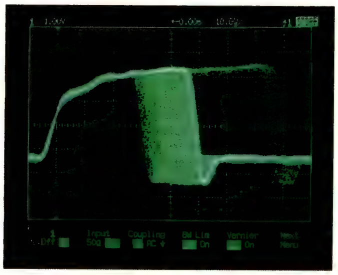
CIRCLE 321 FOR RESPONSE OUTSIDE THE U.S.

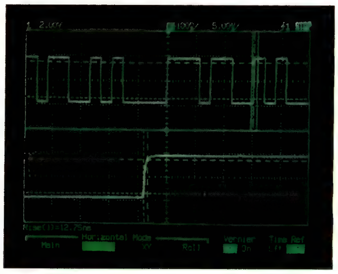
The best thing about our 500 MHz scope isn't the low price.



It's what you get for it.


Just like an analog scope, HP's 500 MHz oscilloscope has a real-time display that responds instantly to changes in your waveforms or controls.


A bright trace and convenient, push-button functions like Autostore let you easily see and store tough-to-find signals.


Pretrigger viewing and delayed sweep mode help you save time by grabbing and displaying signals before or after the trigger event.

© 1993 Hewlett-Packard Co. TMPMO345/INTL

How we can offer you a 500 MHz, delayed sweep scope that's within budget, without compromise.

High bandwidth digital scopes have always forced you to sacrifice two things you love about analog scopes: a familiar look and feel and immediate, believable displays.

Our engineers didn't think you should have to make that compromise. So they designed the HP 54610A oscilloscope with the analog-style interface you're comfortable with, and a new digital architecture that produces waveform displays superior to analog scopes.

The result: you get the quality and performance you'd expect from HP. At a price you wouldn't.

Call HP to see how much scope you can get for your money.

Discover just how easy it is to afford a high bandwidth, high accuracy oscilloscope by calling your local HP sales office or one of the numbers listed below. Once you hear the price, we think you'll agree it's the best deal of any 500 MHz scope.

In fact, you can learn more about the HP 54610A scope's sweep speed, time base accuracy, digital storage and any other specifications you may need to make the right decision by talking to your local HP field engineer.

So give us a call. And discover how much more you really get from HP today.

There is a better way.

HEWLETT PACKARD

CIRCLE 126 FOR U.S. RESPONSE

CIRCLE 127 FOR RESPONSE OUTSIDE THE U.S.

Australia (008) 033-821 • France (1) 69-82-65-00 • Germany (06172) 16-1634 • Hong Kong (852) 848-7070 • India (11) 463-2379 • Italy (02) 9212-2241 • Korea (2) 769-0800 • Netherlands (020) 547-6669 • PRC (1) 505-3888 • Singapore 291-8554 • Spain 900 123-123 • Sweden (08) 750-20-00 • Switzerland (057) 31-21-11 • Taiwan (2) 717-9524 • United Kingdom (0344) 362867

CIRCLE

521 SWITCHING BOOST REGULATOR USES 555

DAVID LAUDE
7040 Franciville Rd., Colorado Springs, CO 80908.

While working on a "B" battery replacement for antique battery-powered radios, it occurred to me that the venerable 555 timer might be able to handle most of a switching regulator's task. This circuit does just that *(see the figure).*

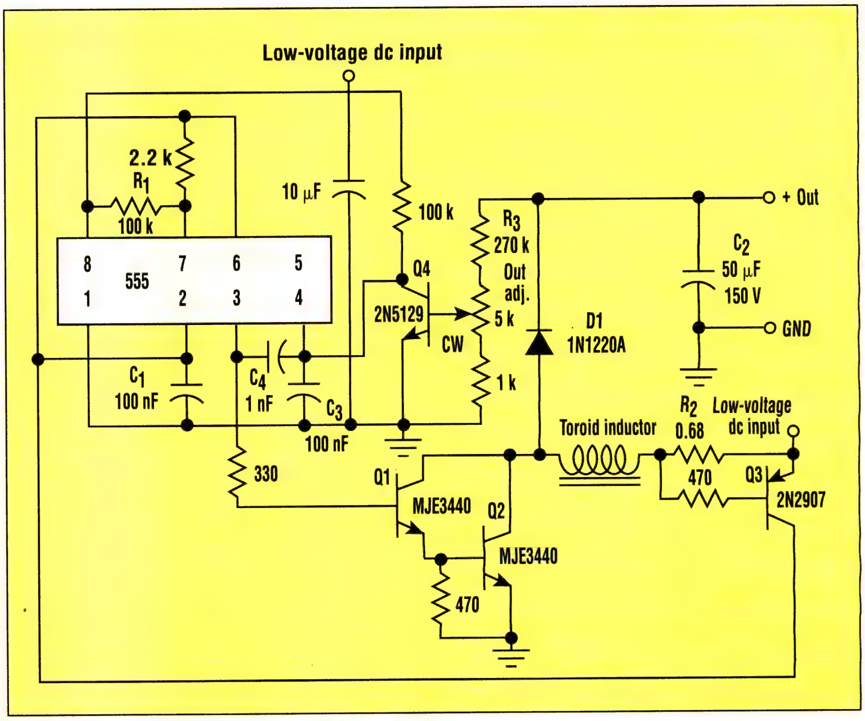
During operation, C_1 is alternately charged and discharged. Resistor R_1 ensures that C_1 begins charging. It also sets the minimum switching frequency. While C_1 is charging, pin 3 of the 555 timer drives Darlington pair Q1-Q2 to supply current to the inductor. When the inductor current reaches a value determined by R_2 and Q3's base-emitter turn-on voltage, the collector current of Q3 will rapidly charge C_1.

When the voltage across C_1 reaches the point where the 555 will reset, the voltage on pin 3 will go low, turning Q1-Q2 off. This action saves from consuming more power than is needed from the supply. At the same time, pin 7 will begin to discharge C_1. During this turn-off event, the collector voltage of Q1-Q2 will be pulled high by the inductor's flyback action. Diode D1 steers the inductor current into storage capacitor C_2. When C_1's discharging voltage reaches the set threshold, pin 3 again goes high to repeat the cycle.

Output-voltage regulation is accomplished by monitoring the voltage across C_2. Whenever Q4 turns on (an indication of excess output voltage) the collector pulls the 555's reset pin low. This turns off the drive to Q1-Q2 until the output voltage drops slightly. C_3 provides low-pass filtering to help the circuit remain stable during regulation. When pin 3 switches low, C_4 provides hysteresis to pin 4 for added stability.

The component values shown, chosen from my junk box, worked well to supply 80 V at 10 mA from a 7.5-V input with about 60% efficiency. The toroid's inductance is several hundred microhenries. R_3 can be modified to grossly adjust the regulation voltage. A grounding and power-supply wiring scheme that isolates current glitches on Q1-Q2 from the control electronics will help to maximize performance. An additional capacitor, connected across pins 1 and 5 of the 555, will help reduce the influence of supply noise.

The circuit will exhibit some temperature drift due to the base-emitter turn-on voltages of Q3 and Q4 being used as reference voltages. The device works very well in uses around the home or in the shop.☐



THIS 555-TIMER-BASED CIRCUIT can function as a switching regulator. With the component values shown, the device supplied 80 V at 10 mA from a 7.5-V input with about 60% efficiency.

CIRCLE

522 RUN OPTOISOLATOR AT 100 kHz, LOW POWER

B.R. BEER
Fisons Instruments, Floats Rd., Wythenshawe,
Manchester, United Kingdom M23 9LE.

This circuit can drive an inexpensive optocoupler with high voltage isolation at frequences above 100 kHz using an AD654 voltage-to-frequency converter. The AD654 provides an open collector output with 50% conduction duty cycle. It pulses the optoisolator input current by discharging C_1 into the diode. Transistor Q1 is switched off while the AD654 conducts. Q1 then recharges C_1 during the second half of the cycle.

The value of C_1 is chosen to suit the type of optocoupler. In practice, this value has been found to be less critical than the value of resistor required for conventional constant-current mode. Typical values range from 1 nF to 10 nF.

We know the ins and outs of digital media. And everything in between.

To get the complete picture in digital media, turn to our complete family of solutions.

We offer what you need to integrate digital media into your next system, including innovative ICs for the input, manipulation and output of digital video and audio signals.

So now, for the first time, you can bring dazzling studio effects right into your customer's desktop.

Our experience in digital signal processing for real world video applications is unrivalled. And we offer all the features you'd expect from a company with Philips' track record in digital video and audio.

There's a line-locked clock for frame-to-frame video stability. Standard 5-volt operation. Plus highly accurate Sigma Delta audio conversion between digital and analog audio.

	INS		IN BETWEENS		OUTS	
AUDIO	SAA7360	Audio A/D	PCF5020	Audio DSP	SAA7323	Audio D/A
	TDA1016	Mic Amp ALC	TDA6330	Audio Control	TDA1545	Continuous Calibration D/A
			TDA8425	Audio Control	TDA7052A	1W Power Amp w/ Volume Control
			TDA1315	Digital Audio Input Output	TDA1519	2 x 10W Power Amp
VIDEO	TDA8708	Video A/D with Clamp and AGC	SAA7192A	Digital Color Space Converter	SAA9065	Video Triple D/A with features
	SAA9051	7-Bit Digital Color Decoder	SAA7186	Digital Video Scaler	SAA7199B	Digital Video Color Encoder
	SAA7151B	8-Bit Digital Color Decoder			SAA7169	Video Triple 9-Bit D/A
	SAA7191B	8-Bit Digital Color Decoder			TDA8702	Video 8-Bit D/A

For more information, contact us today.

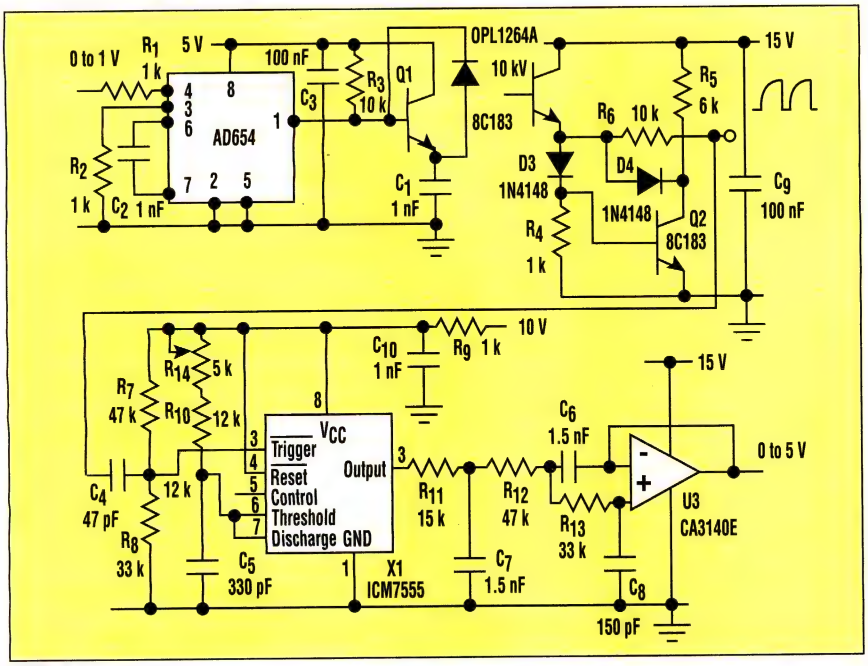
You'll be dealing with a supplier who knows digital media inside, and out.

Philips Semiconductors - Europe: Fax: +31 40 724825. Asia-Pacific: Fax: +886 (2) 500 5888.

Philips Semiconductors

PHILIPS

CIRCLE 186



AN AD654 voltage-to-frequency converter is used to drive a high-voltage-isolation optocoupler at over 100 kHz. The converter, which supplies an open collector output with 50% conduction duty cycle, pulses the optoisolator by discharging C_1 into the diode.

If C_1 is too large, the phototransistor won't recover by the end of the cycle and Q2's collector voltage will remain low. For a transmission frequency of 100 kHz, an ideal value of C_1 will keep the collector voltage of Q2 near to the ground rail for 5 µs after the capacitor discharges. The circuit shown has operated at frequencies in excess of 180 kHz.

It's interesting to note that the response time from the discharge of C_1 to the falling edge of Q2 is less than 200 ns. The average current taken by the optocoupler diode and drive transistor is proportional to frequency and is less than 1.5 mA at 100 kHz.

To complete the design, a CMOS 555 timer configured as a 5-µs monostable followed by an active filter makes a low-cost frequency-to-voltage converter with a 0-to-5-V output range. Circuit nonlinearity is less than one bit for 8-bit applications. R_{14} is an offset control.☐

Guidelines on Length for Ideas for Design Submissions

Space is limited in the Ideas for Design section. Many submissions are returned to the authors simply because they are too long or require too many illustrations.

The ideal length is between one and two double-spaced typed pages with just one illustration.

If a second illustration is required, it should be substantially smaller than the primary diagram. Oscilloscope photos can be included if they show results, but be sure to include voltage and time scale settings.

If the idea is accepted, we will edit it and return a copy to the author for a final technical accuracy check before publication. We will redraw all diagrams to conform to our style.

CIRCLE

523

KEEP I_C AND V_{CE} CONSTANT

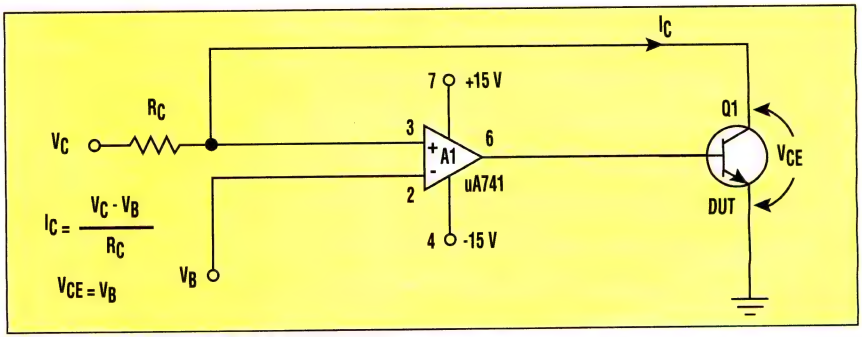
S.J. PRASAD

Tektronix Inc., Electronics Research Lab, P.O. Box 500, MS 50-223, Beaverton, OR 97077-0001.

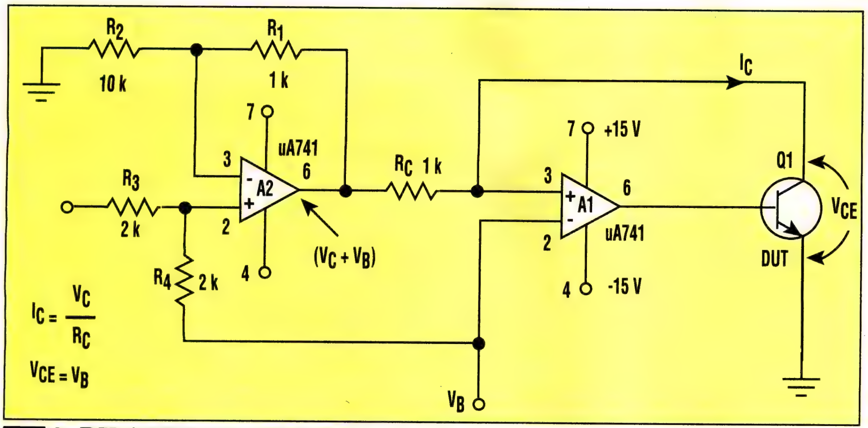
Often, when making dc and rf measurements, it's necessary to bias a transistor at a precise collector current (I_C) and collector-emitter voltage (V_{CE}). In reliability tests, I_C and V_{CE} should be maintained constant even though the device's beta may be degrading with time.

Conventional bias can't maintain constant I_C and V_{CE} if there's a wide variation in beta (such as 5 to 500). Moreover, if the emitter must remain grounded for RF measurements, problems arise in maintaining a constant bias.

This circuit *(Fig. 1)* maintains constant I_C and V_{CE}. The device under test (DUT) is connected to op amp A1. The bias supply (V_B) is connected



1. BIASING A TRANSISTOR at a given I_C and V_{CE} is difficult if a wide variation exists in beta. Bias supply V_B sets V_{CE}. I_C can be set by V_C and R_C. However, I_C depends on V_B.



2. BY ADDING A NONINVERTING summing amplifier (A2) to the Figure 1 setup, I_C can be adjusted independent of V_B.

to the inverting input (pin 2) of A1. Because transistor Q1 is in the feedback loop with A1, the noninverting input (pin 3) is also at the same potential V_B. The noninverting input is connected to the DUT's collector, and V_B precisely sets V_{CE}. In addition, because the noninverting input doesn't draw any current, the I_C should come from the collector supply (V_C). By choosing V_C and R_C, the I_C be precisely set, independently of beta. However, if V_B is varied, I_C will change.

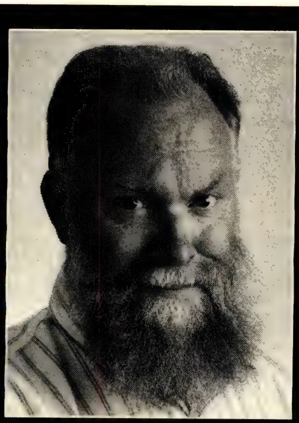
To make I_C independent of V_B, a noninverting summing amplifier (A2) is added *(Fig. 2)*. With the component values chosen, the output of A2 will always be at a potential of $V_C + V_B$. Comparing Figure 2 with Figure 1, it can be seen that I_C is now independent of V_B. Since I_C is now supplied by A2, V_C need not provide large currents. With $V_C = 1$ V and $V_B = 5$ V, Q1 will be biased at $I_C = 1$ mA and $V_{CE} = 5$ V. To prevent Q1 from oscillating, capacitors should be added at the collector and base terminals of the DUT.☐

VOTE!

Read the Ideas for Design in this issue, select your favorite, and circle the appropriate number on the Reader Service Card. The winner receives a $150 Best-of-Issue award.

Send in Your Ideas for Design

Address your Ideas-for-Design submissions to Richard Nass, Ideas-for-Design Editor, Electronic Design, 611 Route 46 West, Hasbrouck Heights, NJ 07604.



MEET
BOB PEASE
AT WESCON /93
SEPT. 28-30
ELECTRONIC
DESIGN
BOOTH 7803/7804

Wescon®/93

Bob Pease, the author of Electronic Design's popular Pease Porridge column will be at Electronic Design's Wescon booth 7803/7804 to meet with readers.

If you are attending Wescon, stop by and give Bob your comments, opinions, and/or rebuttals on the many issues he has brought to light in his provocative columns in Electronic Design. Or just to simply say hello.

The details of Bob's schedule will be posted at the booth.

Some fast pulses or glitches happen very rarely. And, like the one above, they may be as narrow as one or two nanoseconds.

Capturing these signals needs a fast real-time scope. Slower analog or digital scopes won't give you the whole picture. The 9360 from LeCroy will.
It's the world's first DSO with 5 GigaSamples per second single-shot digitizing on two channels. That's 200 picoseconds per point. At a much lower price than you might expect.

For more information, and a FREE Applications Notebook, call LeCroy now. Because some things only happen once.

1-800-4-LeCroy
(1-800 453 2769)

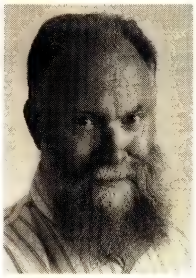
LeCroy Corporation
700 Chestnut Ridge road - Chestnut Ridge, NY 10977-6499
Phone: 1-800-5 LeCroy - (914) 425-2000 - Fax: (914) 425-8967

LeCroy
The Digital Scope Specialists

CIRCLE 142 FOR U.S. RESPONSE

CIRCLE 143 FOR RESPONSE OUTSIDE THE U.S.

PEASE PORRIDGE



BOB'S MAILBOX

Dear Mr. Pease:

I hope you realize what you have just done: You have secured from Dr. Genichi Taguchi the most significant statement ever made by anyone on the application of Taguchi methods: "We are not interested in any actual results..." From now on engineers should understand that this "Taguchi stuff," as you called it, is simply a game of "virtual quality" (which, like "virtual reality," is exciting and engaging as long as the goggles and gloves are on, and the player does not have to worry about what's going on in the real world).

And I would suspect thousands of those who have paid good money for Taguchi books, Taguchi courses, Taguchi workshops, Taguchi videotapes, Taguchi software packages, and what have you, would all of a sudden see the light and ask for their MONEY BACK—and that's "loss to society"!!

T.N. GOH
Professor
National University of Singapore

Gee, that sounds like a NET GAIN to society to me.—RAP

Dear Bob:

Last week, after reading your column "What's All This Taguchi Stuff, Anyhow?" in the June 10 issue, I was in a local *Computer Literacy* book store and came upon a Taguchi Methods book.[1] I purchased it, and have made some notes for your interest.

Perhaps of greatest interest to your readers is the book's chapter 11: "Tolerance Design and Analysis of Audio Circuits."[2] The authors applied Taguchi Methods to the selection of resistors and capacitors in a third-order high-pass filter, which used one op-amp (assumed ideal), 4 resistors, and 4 capacitors.

As usual, the Taguchi Method was used in two stages: first, the "optimum" nominal values of each resistor and capacitor were determined; then, "optimum" tolerances for each component were selected. The goal was to assign component values and tolerances so that the circuit met its specifications with minimum variability.

To find the optimum nominal values of the eight components, the transfer function of the filter was computed in terms of R1-R4 and C1-C4. Three possible values of each component were chosen, giving $3^8 = 6561$ different circuit possibilities. Then "Taguchi methods" were used to design an "experiment" whose objective was to find the best or optimum circuit among these 6561 different choices of R1-R4 and C1-C4, but by using only 27 runs, not 6561.

Two specifications were defined: the roll-off of the gain at 300 Hz versus the gain at 1 kHz, (–3 dB min) and the amount of peaking at 700 Hz versus the gain at 1 kHz (±1 dB max). Surprisingly, there was no spec for mid-band gain; the only two specs concern gain ratios (roll-offs).

Then the Taguchi Method was implemented. After some Latin-square orthogonal-array monkeying around, the Method calculated that the optimum component values are: R1 = 15 k, R2 = 100 k, R3 = 5.6 k, R4 = 10 k, C1 = 0.022 µF, C2 = 0.022 µF, C3 = 0.015 µF, and C4 = 0.022 µF.

Next, the assignment of tolerances was undertaken. The original tolerances on resistors were 2%, and tolerances on capacitors were 10%. The Taguchi Method concluded that capacitors C3 and C4 should be tightened up to 5% tolerance; C1 and C2 can remain at 10%, and R1-R4 can remain at 2%.

Emboldened by your column, Bob, I decided to play the role of Doubting Thomas: Is it reasonable that these two specs required 2% resistors and 10% capacitors to get a working, production-worthy circuit? My intuition said, "No."

So I decided to select the components myself, using traditional (non-Taguchi) methods. My goal was to use 10% resistors and 20% capacitors, and still get 100% of all filters to meet both gain roll-off specs.

If this is possible, then the circuit could be manufactured much more cheaply, resulting in lower costs, higher sales, and in the words of Taguchi, smaller "loss to society."

I used about the same set of $3^8 = 6561$ possibilities as the Taguchi investigators. I just chose a different final set of circuit values—R1 = 12 k, R2 = 100 k, R3 = 5.6 k, R4 = 10 k, C1 = 0.01 µF, C2 = 0.015 µF, C3 = 0.01 µF, and C4 = 0.022 µF.

I checked out my design by performing some computations. When you insert different component values into the transfer function for this circuit, it's easy to see their effect upon the response, and to see if a particular set of components passes or fails the roll-off specs.

So, using Monte Carlo techniques, with 10% nominal resistors and 20% capacitors, I generated 50,000 different high-pass filter circuits. I was pleasantly surprised to see that all 50,000 circuits "passed" the roll-off specs, using those low-cost parts.

Then I decided to check out the Taguchi-Method-derived circuit, as it was supposedly "optimized" for reduced variability. Maybe it would also yield 100% when 10% resistors and 20% capacitors were used? Here's my results: 73 of 50,000 high-pass circuits using Taguchi-optimized values failed the 300-Hz test, and 1243 failed the 700-Hz test. In other words, yield for the Taguchi-optimized circuit was 97.4%, when low-cost component tolerances (10% resistors, 20% capacitors) were used.

Bob, I am disappointed. The Taguchi Methods gave a circuit that requires *higher-cost* components to achieve 100% yield. Conventional (non-Taguchi) design procedures produced a circuit that had a yield of 100% when *lower-cost* components are used. Maybe some of your colleagues who advocate the Taguchi method can explain what went wrong?

PEASE PORRIDGE

1. Taguchi Methods (Proceedings of the 1988 European Conference), Elsevier Applied Science, London & New York.

2. Ibid., Chapter 11, authored by N. Logothetis and J.P. Salmon, p. 111.

MARK JOHNSON
Los Altos, CA

Well, that is a good question! I always wondered if the Taguchi "optimization" methods really provided an optimum. I wonder where Mr. Logothetis got his "optimization" computer programs. Did he develop them himself, or get them from Mr. Taguchi, or from Taguchi's American Supplier Institute? Not that I care. AND this is NOT the first time that a Taguchi-expert claimed he "optimized" a circuit, when all he did was improve it a little (Phadke, Madhav, Quality Engineering using Robust Design, Prentice-Hall, Englewood Cliffs, N.J., 1979, p. 185-187). Personally, I usually use a circuit with 3 resistors and 3 capacitors to make a simple Sallen-Key filter. The response specified does not require 4 Rs and 4 Cs. I have not yet proven that I can't do it with 2 resistors and 2 capacitors. But I did check Mr. Johnson's computations, and I agree that his math is correct, and his optimum values are as good as he said, for 100% yield with cheap 20% capacitances.

NOTE: Mr. Logothetis' optimization study apparently covered and "bracketed" Mr. Johnson's "optimum," but failed to recognize it. Logothetis had the better optimum right in his sights—but failed to pull the trigger! I wonder why. I guess it just goes to show, thinking and checking your results beats trusting your computer any day.

NOTE: The Taguchi enthusiasts like to use a minimum number of computations—just 27 or 54 runs. Mr. Johnson decided to run several tens of THOUSANDS of runs. Who's living in the past?

NOTE: For a circuit that needs 5% capacitor tolerance, you have to buy good 2% capacitors so they do not drift out of a 5% spec versus time or temperature, and those capacitors really are expensive. Maybe the real "loss to society" is spending $72 on a book that says you must use tighter tolerance components when cheaper ones will actually do just fine.....—RAP

Dear Mr. Pease:

I am very interested to hear about Dr. Taguchi's comments on the "voltage regulator" that does not regulate. Let me point out a statement in a book, *Introduction to Statistical Quality Control* by Douglas C. Montgomery, Wiley, 1991, p. 543, regarding the specific methods of experimental design and data analysis used in the Taguchi approach to parameter design:

"On the other hand, many companies have reported success with the use of Taguchi's parameter design methods. If the methods are flawed, why do they produce successful results? Taguchi advocates often refute criticism of the methods with the remark that 'they work.'

We must remember that the 'best guess' and the 'one-factor-at-a-time' methods will also work, and occasionally they produce good results. This is no reason to claim they are good methods. Most successful applications of Taguchi's technical methods have been in industries without a history of good experimental design practice. Designers and developers were using the best-guess and one-factor-at-a-time methods (or other unstructured approaches), and since the Taguchi approach is based on the factorial design concept, it will often produce better results than the method it replaces. In other words, the factorial design is so powerful that even when it is used inefficiently, it will work better than most anything else."

So when Taguchi and his disciples wish to slough off criticism of their methods, they argue that "they work." But when Taguchi wishes to brush off criticism of his results, he says it is only the optimization *method* that is important. Can Taguchi have it both ways? Not after June 10, 1993. *(Myself, I like the Blind Squirrel Theory—even a Blind Squirrel can find a nut occasionally. In some cases, I prefer Monte Carlo Analysis because it's easy to do and it searches at random places in the interior of Component Space, not just around the perimeter. But in other cases, factorial methods are indeed suitable, and efficient. —RAP)*

Also in the same book, same page, author Montgomery observes, "A final point concerns the learning process. If the Taguchi approach to parameter design works and yields good results, we may still not know what has caused the result because of aliasing of critical interactions. In other words, we may have solved a problem (a short-term success), but we may not have gained *process knowledge*, which could be invaluable in future problems."

NAME WITHHELD ON REQUEST

I agree completely: If we trust a computer to process a huge stack of data, and it spits out a good answer (and, as we have seen, that is not a trivial matter), we have neither learned what's right nor how to go in the right direction next time. We haven't developed a feeling for the derivatives, because Mr. Taguchi told us not to bother with those—they are too difficult. He wants to keep us in the dark, and not to develop our intuition. He just wants us to trust him, and to use his method, and trust the results it puts out. Hey, maybe it's Mr. Taguchi that is the Blind Squirrel! Further, if there's any false data in the input deck, we would never realize that was what caused funny outputs. Taguchi's analysis is not likely to spot that a typo error is causing false results.—RAP.

Dear Bob:

I cringed when I read the letter (name withheld) in the May 27 Bob's Mailbox, praising the "degreed engineer." I'll give you my experience for what it's worth.

I run a small electronics engineering company in the North of England. Two of us design our products, both software and hardware. We both learned by "reading hobby magazines" and generally devoting ourselves to the subject at hand.

Actually, we've been reading the magazines since we were kids and I'm now approaching 40. I know very little about higher mathematics and virtually nothing about laminar flow. But our speech products have won awards from the chip manufacturers, and our

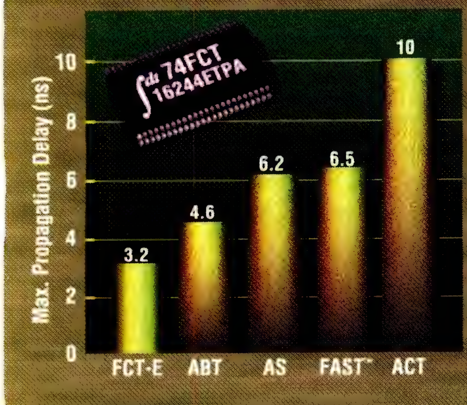
Fast and Free*!

IDT's New FCT-E Speed Logic

The Fastest Logic

IDT's new FCT-E Speed Double-Density™ logic frees your system performance with propagation delays as low as 3.2ns (t_{PD} max.), making it 30% faster than alternative Widebus™ and other CMOS-based solutions! And, unlike those other logic families, you get increased performance without an increase in power dissipation. IDT's new FCT-E Speed devices use significantly less power than any other CMOS, BiCMOS, or Bipolar logic family, increasing system reliability and extending battery life.

How Fast is FCT-E? 3.2ns!



Virtually Noise-Free

IDT's FCT-E Double-Density devices don't waste precious nanoseconds waiting for signals to settle. Typical ground bounce is <600mV. High-drive and balanced-drive output configurations are available to match the specific requirements of almost any application.

Twice the Logic in Half the Space

IDT's 16-, 18-, and 20-bit Double-Density logic devices are now available in new, low-profile 48- and 56-pin TSSOP packages that make them more compact than ever before to free up board area. TSSOP packages save over 62% board area compared to two SOICs, and over 35% board area compared to 48- or 56-pin SSOPs! And they're only 1.09mm in height, making them ideal for PCMCIA applications.

*Free Samples

Find out more about *fast* FCT-E logic. Call or FAX us today, and get free copies of the High-Speed Logic Data Book, Design Guide, and a request card for free samples so you can try IDT's fast FCT-E logic for yourself.

(800) 345-7015 ▲ FAX: 408-492-8674

ASK FOR KIT CODE 3101

Double-Density is a trademark of Integrated Device Technology, Inc. All others are trademarks of their respective manufacturer.

Integrated
Device Technology, Inc.

single-chip designs are in use in demanding applications the world over.

Ten years ago, we developed a videotape control system so sophisticated that the press found it necessary to call it "an amalgamation of Japanese and American technology," though it was developed from scratch in the one-time mining area of Newcastle Upon Tyne in England.

Since then, we have gone from product to product with no help from universities or outside bodies. Our latest product has received a glowing review from Jerry Pournelle of BYTE magazine, as well as virtually every U.K. computing magazine.

I have run local computer clubs in my spare time and I know technical folk worldwide. I'm not showing off, but am qualifying my viewpoint: I firmly believe that when it comes to producing the goods, the only difference between a "highly qualified" expert and a self-taught expert is a piece of paper. What *is* important is dedication, clear thinking, and more dedication. You will often find lots of that in duly-qualified engineers, but only because it was there in the first place.

I certainly wouldn't want to put anyone off going for qualifications. By all means, it will help your salary and enrich your knowledge. But don't think for a minute that a piece of paper is going to turn an ordinary guy into a star designer... absolutely not! Never has, never will. Name NOT withheld!

PETER SCARGILL

Newcastle Upon Tyne, England

Normally I shriek and holler in favor of clear thinking, but I'll admit that dedication is an essential ingredient!—RAP

Dear Bob:

The idea that a degree somehow makes a person a better worker is absurd! Also, the fact that someone has a degree from an unaccredited or unrecognized school does not mean that person is a bad worker.

For part of my two years as an Army draftee, I worked as an "electrical engineer assistant." My degree was in physics, with only one class in electronics. I worked side-by-side with several EEs, including one from MIT. There was one other draftee whose degree was in physics.

Both of us physics graduates had learned electronics by hands-on personal experiments. The EEs learned all they knew in the classroom and limited lab work. Yet it turned out we physicists could run circles around all of the others.

The need for a degree is, in my opinion, very overrated. When will industry and government recognize that pay should be related to performance? There should not be any artificial pay caps based on education. If the person has the knowledge and experience to get the job done correctly and in a timely manner, that person should be paid the same as another without reference to education.

At this time, I have 38 years of experience, which has qualified me in ways no classroom at any level can do. But I am (obviously) over 40 and therefore "outdated." People forget that we "oldtimers" have not only all that work experience, but also have read—yes, studied—thousands of pages of technical material and books to keep up.

Yet a new hire today that has a PhD can be hired at a higher grade than I am, despite the fact that many new PhDs don't have the foggiest idea what goes on in the real world of work. Performance is NOT the name of the game in many places. It is too often *who* you know and not *what you know how to do* that gets the cake.

Now don't get me wrong. Education serves a very useful place. But on-the-job education is also very useful. The point is that automatically separating engineers and technicians based solely on "formal" education, and ignoring the real-world, on-the-job education, is the cause of too much arbitrary discrimination.

GORDON SIMKIN

La Luz, New Mexico

I'll pay for a can-do guy everytime, but the world does generally pay a premium for educational status, all things being equal. I can't change the the world.—RAP

Bob:

In the May 27 issue, your column had a letter from an individual who complained about the whining of non-degreed engineers. Your answer proved what I have often suspected: You truly are a sanctimonious cretin!

You stated, *"I don't find all that much correlation between the degree and the abilities. Surely a lot of degreed engineers can't remember how to compute the rms value of a lumpy waveform."* I can't believe this! Just how many non-degreed engineers do you figure can compute that? If you do a little checking, you'll find that almost without exception those who claim that degrees are of dubious value are those who don't have one (but wish they did). Similarly, I have observed that those with only bachelor's degrees often feel graduate degrees are not needed. (Gee, Bob, see any correlation there??)

Engineers with graduate degrees have learned design and analysis techniques that those without degrees (or those only with bachelor's degrees) have never even heard of. How many non-degreed engineers have a sufficient mathematics background to design digital filters with attenuation-band adjustments? Or to design multifunction pipelines, lead-lag compensators, etc.?

...The purpose of this letter is not to vilify non-degreed engineers; it is simply to put things into perspective. There are gainful employment opportunities in the engineering field for people with little formal education and for those with PhDs. But, this doesn't mean all should be accorded the same status or prestige. If non-degreed engineers want to be treated the same as degreed engineers, then they should stop whining, get off their behinds, and go to school.

NAME WITHHELD (DISGUSTED)

I'm sorry, but I don't agree with you at all—not on anything. Almost every "non-degreed engineer" knows five or ten amazing, useful things that you or I couldn't hack. Good for them! Everybody knows something! Aren't you glad I'm not your boss? I'm glad you aren't my boss.—RAP

Want to say hello to Bob Pease in person? He'll be at Electronic Design's Wescon booth 7803/7804, Sept. 28-30, to meet with readers. Details of his schedule will be posted at the booth.

QSI FCT-T DELIVERS ULTIMATE PERFORMANCE IN LESS SPACE

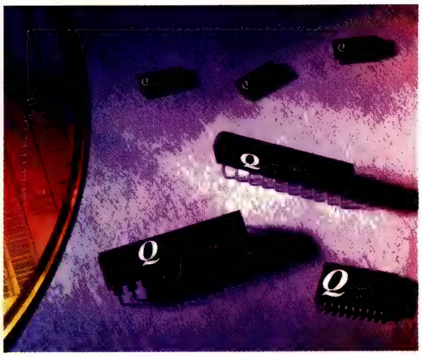
(actual size)

Quality Semiconductor's high-performance FCT-T family of logic devices are designed to solve your toughest bus interface problems. Our high-speed, low-power, low-noise products pack all their performance into a smaller package. And because QSI® offers well over 60 basic types, we've got the part to fill virtually any need.

400% More Space. Our FCT-T family is packaged to save you more board space than any other available solution. 400% more! We call it QSOP: Quarter-Size Outline Package. Half the

length and half the width of standard SOICs, QSOP gives you four times the density. Those shorter inter-chip distances help pump-up your system's performance.

D Grade Speed. In speeds up to D grade, QSI's FCT-T family of parts are built into some of the fastest systems in the world — a feat made possible through our patented QCMOS® technology, the state of the art in CMOS processing today. Low CMOS power consumption also results in outstanding system performance and reliability.



Quiet Performance. At QSI, we strive to reach well beyond the industry standard. That's why we added input hysteresis for reduced noise sensitivity. To lower ground bounce, we limited the output swings to 0 to 3.5V and carefully controlled the slew rates. And that's why we developed the FCT2000 series with 25 ohm series termination resistors built right into the chip — all without sacrificing a single nanosecond of speed! Combine that with our low inductance QSOP package and you've got one of the quickest CMOS devices on the planet!

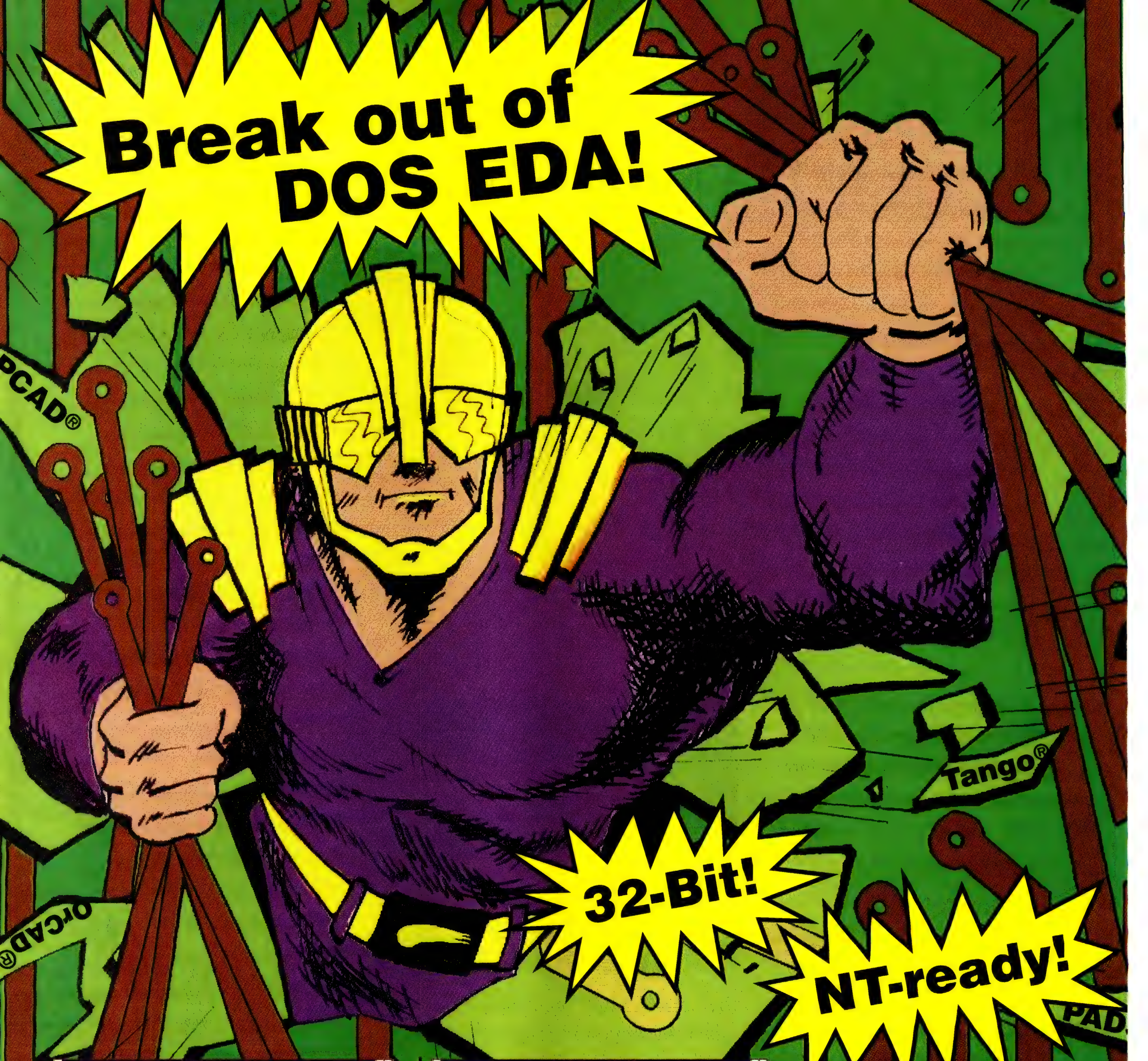
The QSI Standard. QSI's FCT-T logic products are simply some of the fastest CMOS devices available. Choose from A, B, C — and now D — speed grades. And every device is fully JEDEC-FCT spec compatible.

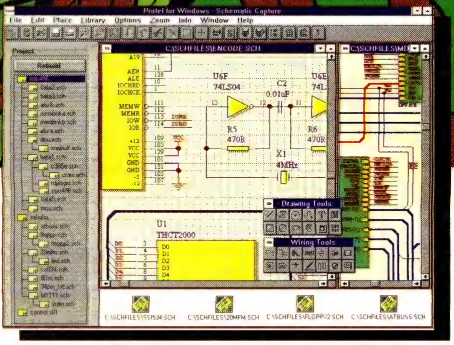
QSI offers the most comprehensive set of solutions available for your high-performance design problems, including our QuickSwitch,® SRAM and FIFO products. Call our high-speed hotline today at (408) 450-8063 to request our new 1993 databook. Better yet, fax us at (408) 496-0773.

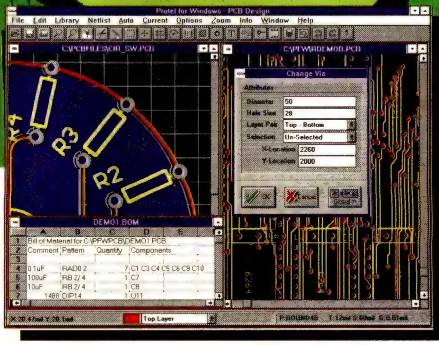
Quality Semiconductor, Inc.
851 Martin Avenue, Santa Clara,
California 95050-2903

Q, QSI, QuickSwitch, and QCMOS are registered trademarks of Quality Semiconductor.

CIRCLE 264 FOR U.S. RESPONSE CIRCLE 265 FOR RESPONSE OUTSIDE THE U.S.




Protel for Windows - Schematic Capture
File Edit Place Library Options Zoom Info Window Help


Protel for Windows - PCB Design
File Edit Library Netlist Auto Current Options Zoom Info Window Help
Change Via
DEMO1.BOM

Advanced Schematic **Advanced PCB 1.5**

800-544-4186

Protel Technology, Inc.
Phone (408)-243-8143; Fax (408)-243-8544
4675 Stevens Creek Blvd. Suite 200
Santa Clara, CA 95051-6764

MICROSOFT WINDOWS COMPATIBLE

Leave the limitations of DOS behind and experience the power of a fully integrated Windows™ EDA system. *Advanced Schematic* and *Advanced PCB*, the #1–selling schematic entry and PCB layout packages for Windows give you the power you need to make your design dreams into reality. If you're ready to move up to real power in your EDA tools, call Protel.

Protel Technology
FIRST IN WINDOWS EDA

Specifications are subject to change without notice. All product names are trademarks of their respective manufacturers. Copyright © 1993 Protel Technology.

SEE US AT WESCON 93, BOOTH # 2350

CIRCLE 192 FOR U.S. RESPONSE CIRCLE 193 FOR RESPONSE OUTSIDE THE U.S.

ELECTRONIC DESIGN QUICK LOOK

EDITED BY SHERRIE VAN TYLE

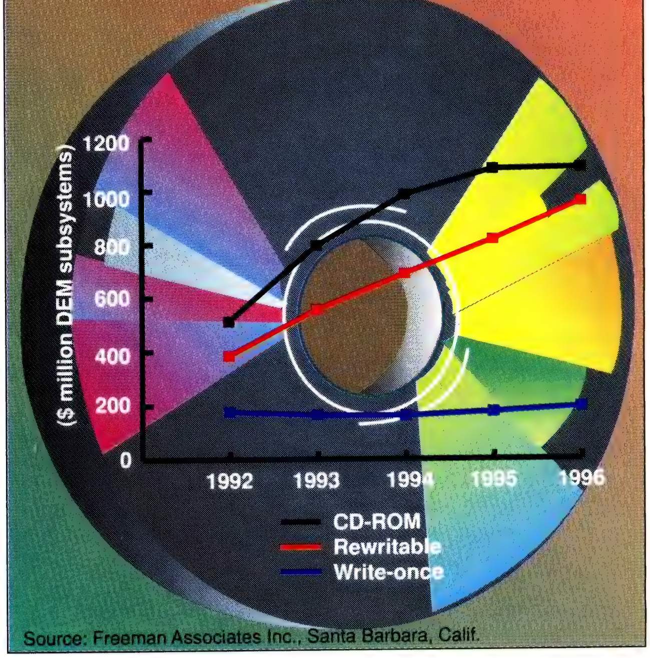
MARKET FACTS

From 1992 to 1993, the market for optical disk drives grew 76%; last year saw shipments of 2.6 million units, which is expected to increase to 4.5 million units in 1993 and to 11 million units in 1998. That's according to Robert C. Abraham and Raymond C. Freeman Jr., authors of the Freeman Report, *Optical Data Storage Outlook, 1993.* The Santa Barbara, Calif., market researchers point out that CD-ROM drives accounted for 86% of all optical units shipped last year for data storage and 48% of total revenues for optical drives.

The worldwide market for all types of optical disk drives will approach $2.5 billion at OEM prices in 1998, a 15% compounded growth rate from the $1 billion value of the 1992 market, the report predicts. Projected revenues for 1998 are divided between rewritable and multifunction products at $1.2 million (49% of total revenues); CD-ROM drives at $1 billion (42%); and write-once devices at $222 million (9%).

CD-ROM drives will lead the optical market in terms of unit volume; 10 million drives are expected to ship in 1998, up 28% a year from 2.2 million units last year. Driving demand for CD-ROM drives are a steady flow of new CD-ROM titles, multimedia applications and declining hardware, software, and replication costs. Production of CD-ROM drives will continue to be dominated by Asian manufacturers because of their established positions in the audio CD market. U. S. companies are involved in electronic publishing, marketing, systems integration, and disk replication.

OPTICAL DRIVES:
U.S. REVENUES KEEP ROLLING ALONG



Source: Freeman Associates Inc., Santa Barbara, Calif.

TIPS ON INVESTING

With retirement costs rising, engineers will need a large nest egg to have financial freedom in retirement. While work-related expenses will decrease, expenses for travel and other leisure activities will most likely increase. And don't forget inflation. One of the most misunderstood and, in my opinion, the absolute best way for engineers to build assets for retirement is the 401(k) plan. Sponsored by corporations, 401(k) plans give engineers the option of investing in several types of investments such as mutual funds, annuities, and common stocks. The earnings on money invested are tax deferred, so the entire amount can be reinvested in the plan, compounding the return. Contributing to the plan also gives engineers immediate income tax savings: 401(k)s are salary reduction plans, which means that contributions are not included in the current year's taxable income.

Engineers eligible to participate may contribute up to 15% of earned income or $8,994, whichever is less, to a 401(k) plan. An employer also may set lower maximum contribution levels. Contribution limits are adjusted annually for inflation. Engineers contribute through a payroll deduction, which makes it easy to fund retirement plans. The company may also contribute to 401(k) plans. Engineers may withdraw money from their 401(k) plan before age 59 1/2 only because of death, disability, termination of employment, or financial hardship. Penalties may apply. But engineers may be able to borrow against the plan and repay principal and interest within five years. Many companies match 50% of an engineer's contribution up to a limit.

Engineers who withdraw from a 401(k) plan because of a job change or the company terminates the plan must authorize a rollover into another tax-qualified plan. Receiving the money instead of doing a direct rollover can make an engineer liable for a 20% withholding tax.

Henry Wiesel is a financial consultant and investment counselor with Shearson Lehman Brothers, 1040 Broad St., 2nd floor, Shrewsbury, NJ 07702. For a complimentary second opinion review of your investment portfolio, send a copy of your current statement to Wiesel at Shearson Lehman.

ORE!

nversion without the NRE.

Slash your per unit cost on FPGA and gate arrays.

Whether you're converting your FPGA designs into affordable ICs, or looking for a second source for your gate arrays, Encore! is a surprisingly affordable answer.

In only a few weeks, Orbit turns your netlists into prototypes and production quantities. So you can cut your per-unit cost very quickly. Or quickly find an alternate source for production of your gate arrays.

- Convert FPGA netlists
- Convert gate array netlists for alternate source
- Get prototypes in as little as three weeks
- Get your choice of packaging options
- Move quickly into full-scale production

Altera, Xilinx, Actel, VLSI Technology, LSI Logic, NCR, AMI, Toshiba and AMD Mach are registered trademarks of their respective companies

For more information on converting your FPGAs and gate arrays with no NRE contact Encore! Technical Sales. (800) 331-4617. In California (800) 647-0222. Phone (408) 744-1800. FAX: (408) 747-1263

ORBIT
SEMICONDUCTOR, INC.

Second Source, First in Service

CIRCLE 176 FOR U.S. RESPONSE
CIRCLE 177 FOR RESPONSE OUTSIDE THE U.S.

ENC

FPGA or Gate Array Co

ALTERNATE SOURCE
FIRST IN SERVICE
FOR
ALTERA
PLD'S

VLSI
TECHNOLOGY

NCR

AMD
MACH

LARGE SCALE
LSI
LOGIC
INTEGRATION

No NRE lets you convert small quantities — even as low as 100 chips.

No NRE means converting FPGAs can make economic sense at quantities under 100 chips. And with our fast-turnarounds on prototypes and production quantities, you can start cutting your per-unit cost immediately.

Gate array users can also affordably meet a sudden demand for product by quickly — and inexpensively — developing an alternate production source.

With Encore!

- No NRE - just fast paybacks
- Cut your per-unit cost on runs as low as 100 chips
- Call Orbit for an easy economic analysis

Encore Base	**44**	**68**	**84**	**100**	**144**	**176**	**208**
# of Gates	**660**	**2,000**	**4,000**	**6,000**	**14,000**	**22,000**	**32,000**
Packages	44 PLCC	68 PLCC	84 PLCC	100 PQFP	144 PQFP	160 PQFP	208 PQFP
	28 PLCC	44 PLCC	68 PLCC	84 PLCC	100 PQFP	144 PQFP	160 PQFP
PLCC	20 SOIC	28 PLCC	44 PLCC	68 PLCC	84 PLCC	100 PQFP	144 PQFP
PQFP	16 SOIC	20 SOIC	28 PLCC	44 PLCC	68 PLCC	84 PLCC	100 PQFP
SOIC					44 PLCC	68 PLCC	84 PLCC
						44 PLCC	68 PLCC

A wide range of packages are available to Encore! users.

How does Orbit slash per-unit cost on quantities as low as 100 pieces?

QUICK NEWS: SEMINARS

Unitrode Integrated Circuits Corp. (UICC) is holding one-day seminars addressing switching power supply design at an intermediate technical level. Seminar fees vary by location. Seminars will be held on Oct. 5, 6, and 7 in Dallas, Houston, and Phoenix; Oct. 12, 13, and 14 in Fort Wayne, Ind., Chicago, and Minneapolis; and Oct. 19, 20, and 21 in Toronto, Ottawa, and Montreal. Contact Joan Paglierani, Unitrode Integrated Circuits, 7 Continental Blvd., Merrimack, NH 03054-0399; (603) 424-2410; fax -3460. CIRCLE 460

The 6th Annual International QNX Users Conference, High-Performance Open Systems, will take place Oct. 17–20, 1993 at Disney's Yacht Club Resort, Lake Buena Vista, Florida. Sessions include QNX and embedded systems, TCP/IP, and QNX/DOS interoperability. For information, contact QNX Software Systems Ltd., 175 Terence Matthews Cres., Kanata, ON, K2M 1W8 Canada; (613) 591-0931; fax -3579. CIRCLE 461

McCabe & Associates will present seminars at the company's Columbia, Md., headquarters on such topics as structured analysis and design, software quality assurance, and structured testing. For information, contact McCabe & Associates, Twin Knolls Professional Park, 5501 Twin Knolls Rd., Suite 111, Columbia, MD 21045; (800) 638-6316; fax (410) 995-1528. CIRCLE 462

The Wescon electronics conference taking place Sept. 28–30, 1993 in San Francisco's Moscone Center will have 15 half-day courses for $10 to $20; short-course topics include surface-mount technology, neural network applications, ISO 9000, PC-based multimedia, and accelerated product development. Contact Wescon, 8110 Airport Blvd., Los Angeles, CA 90045-3194; (310) 215-3976; fax 641-5117. CIRCLE 463

Metrication '93, a national metrics conference, will be held Sept. 30–Oct. 1, 1993 at the Holiday Inn Crowne Plaza, Rockville, Md. The conference is sponsored by the U. S. Metric Association, American National Metric Council, and the National Institute of Standards and Technology (NIST). For information, contact National Metric Conference, 2447 Lexington Pl., Livermore, CA 94550; (818) 368-7443 or (208) 558-9031. CIRCLE 464

QUICK NEWS

Papers are being solicited for the Sun User Group's 11th Annual West Coast Conference, Dec. 7–10, in San Jose, Calif. The theme is the metamorphosis of Sun OS: from classroom to boardroom. For information on the conference or on submission of papers, contact program chair Peter Galvin, (401) 863-7623, e-mail pbg@cs.brown.edu or PCI Trade Show Management, 12343 Hymeadow Dr., Bldg. 3, Austin, TX 78750; (800) 727-3976 or (512) 331-7761; fax -3950. CIRCLE 465

KMET'S KORNER

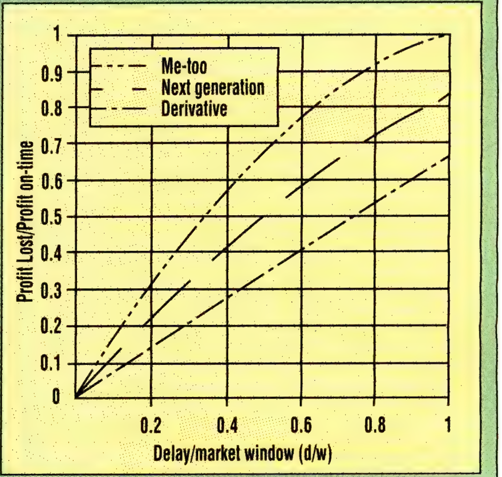
...Perspectives on Time-to-Market

BY RON KMETOVICZ
President, Time to Market Associates Inc.
P. O. Box 443, 100 Prickly Pear Rd., Verdi, NV 89439; (408) 446-4458; fax (408) 253-6085

Managers trade time for money with a bias for conserving the later."

Don Reinertsen

The models, mathematics, and concepts in the previous half-dozen columns helped produce the graph below. I will explain how to use it by describing some real-life situations that I have encountered.



Real situation: The management team of a semiconductor company expects lifetime profits on this next-generation new product to exceed $50 million over a seven-year product life. They have already made provisions to pay $35,000 to train four of their key d-phase staff members on the use of a new design system. Taking these people off the project delays the d-phase, and thereby the entire effort, by two weeks. The design system, required for the execution phase, will not be needed for at least another six months. When the company asked to reschedule the training, they were informed that they would lose their $10,000 deposit. What should be done?

First, let's determine what time is worth on this project. The next generation curve on the chart is reasonably linear. Delay divided by market window, d/w, is approximately equal to profit lost divided by profit on-time. D/w, 0.5/36, is equal to 0.014. A two-week project delay costs $700,000. What should be done? Let's see, if management team members elect to save $10,000, it costs them $700,000. In this situation, this management went for the conservation of time rather than the conservation of money—a wise choice!

Real Situation: A disk-drive company expects lifetime profits on its enhanced product to exceed $15 million over a two-year product life. Adding two engineers to the execution phase team reduces time to market by four months. Costs to add the two experienced engineers to the project were estimated to be $250,000.

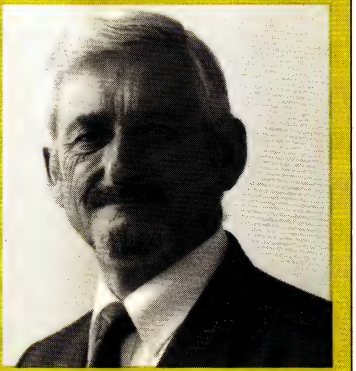
In this situation, a highly competitive one, we make use of the me-too-curve. The d/w ratio is calculated to be 0.33, which results in a profit lost to profit on-time ratio of somewhat greater than 0.43. The cost of delay becomes more than $6.45 million. Were the two engineers added? Of course!

You are now better equipped to begin making time vs. money trade-offs. Take this material and put it to work, improve upon it, and please share some of your experiences with me.

More information on this topic is contained in New Product Development: Design and Analysis, which can be obtained by calling Time to Market Associates.

AN EYE ON ISO 9000

As ISO 9000 gains momentum, it becomes a de facto market requirement, especially in Europe. In many countries, if two suppliers are trying to negotiate the same contract, the one with ISO 9000 registration has a clear competitive advantage. In Europe, more than 25,000 companies have been certified, with the demand on registrars growing. In the U. S., as of May 1993, only 1300 companies were certified, but this figure is estimated to increase to 500,000 in the next three to five years.



The Europeans are using ISO 9000 as a tool to help unify their economies and when approached as an opportunity instead of a burden, it can make an important contribution to a company's competitiveness. The European market will one day be less open to non-certified companies. International standards and openness of conformity assessment are indispensable to eliminating or avoiding technical barriers to international trade.

With the decreasing impact of mil specs because world armaments are being reduced, defense manufacturers will have to survive with smaller defense budgets. To compensate, they are going to have to sell overseas. To do this, they will have to comply with ISO 9000.

Earlier this year, the U. S. military granted defense contractors permission to use ISO 9000 in place of MIL-Q-9858 Military Standard for Quality. Possibly the greatest difference between the two standards and the primary reason ISO is considered broader is that it includes the design function. ISO 9001 includes a section on design control, which requires manufacturers to document areas like contribution of specification in design quality, design planning and objectives, design reviews, configuration management, and design qualification. None of these areas are included in MIL-Q-9858A. However, most defense electronic suppliers already incorporate these areas into DOD requirements, so they should have few problems meeting ISO 9000 requirements.

Companies doing business or hoping to do business with the North American Treaty Organization (NATO) would do well to seek ISO 9000 registration. This year, 16 NATO nations will begin to use the new Allied Quality Assurance publications. NATO's revised Quality Assurance document does not force ISO 9000 series registration. However, many companies see an advantage to formal compliance.

At the end of 1992, of 780 U. S. registrations, 23% came from industrial and commercial equipment and computer equipment companies. Another 14% of the total derived from electronic and other electrical equipment and component companies.

The ISO 9000 series consists of, but is not limited to: ISO 9000—Quality Management and Quality Assurance Standards, Guidelines for selection and use; ISO 9001—Quality Systems, Model for Quality Assurance in design, development, production, installation and servicing; ISO 9002—Quality Systems, Model for Quality Assurance in production and installation; ISO 9003—Quality Systems, Model for Quality Assurance in final inspection and test; and ISO 9004—Quality Management and Quality Systems Elements, guidelines.

With Europe already deeply involved and the Far East moving rapidly and with more U. S. customers plus the Department of Defense recognizing ISO 9000 as a requirement, every company wanting to stay in business now and in the future must seriously address the investment.

A recent report indicated ambivalence on the part of U.S. firms toward ISO 9000. It stated that even though ISO 9000 is widely used in Europe and Asia, a survey of mid-size American companies found that 48% had not heard of ISO 9000; only 8% planned to become registered; and just 11% thought that the standard would affect them a great deal. Chrysler, DuPont, Eastman Kodak, Ford, General Electric, Philips Electronics, and 3M Corp. are big names that have received certification or have begun the task, showing the increasing clout of the ISO Series.

Les Miles, marketing director at Conquest Consultants Ltd. will bring his ISO 9000—The Global Challenge seminars for the first time to U. S. audiences in various cities. For more information, contact International Meeting Services in Westport, Ct.: (203) 454-2259.

OFFERS YOU CAN'T REFUSE

UniView from Unisoft Corp. is free public domain software that brings a graphical picture of any pc board from any CAD system to an IBM PC or compatible. UniView automatically displays the pc-board assembly, components, network nodal and pin information, geometries, traces, and so forth.

UniView requires a database generated by Unisoft's CAD connection system, which enables test and manufacturing engineers to extract data from any CAD system to automatically generate test programs and test fixture designs for automatic test equipment. Contact UniSoft Corp., 1 Corporate Dr., MS 319, Shelton, CT 06484; (203) 925-2980; fax (203) 925-2985. CIRCLE 465

Polytechnic University, Brooklyn, N. Y., offers free software for planning part-time studies at the institute in the areas of electrical engineering, computer science, management, materials and processing, as well as mechanical and related engineering.

To obtain a 3.5- or 5.25-in. DOS disk or a paper version of the listings, contact Polytechnic University, 6 Metrotech Center, Brooklyn, N. Y. 11201; (800) 765-9832; fax (904) 575-7884. CIRCLE 466

Application notes are available on Dialogic Corp.'s bulletin board system (BBS), including the Dialogic ADPCM algorithm, fax/120 load tests under Unix, how to implement an alphanumeric voice-recognition application, among others.

Users can access the BBS by dialing (201) 334-2619. Application notes are placed on the BBS in PostScript format in the file section of the main menu. The files can be copies to any PostScript printer. Contact Dialogic Corp., 300 Littleton Rd., Parsippany, NJ 07054; (800) 755-4444 or (201) 334-8450; fax (201) 334-1257. CIRCLE 467

The New Book Bulletin from Computer Literacy Bookshop gives short reviews of books in electrical engineering, networking and communications, software engineering, programming languages, and other computer-related topics.

The bulletin is available free of charge by contacting Computer Literacy Bookshops, 2590 North First St., San Jose, CA 95131; (408) 435-0744; fax -1823; email: info@clbooks.com. CIRCLE 468

AUTOMOTIVE ICs THAT MAKE YOUR BEST DESIGNS EVEN BETTER

Sensing, Power and Signal Conditioning Circuits for the Next Generation of Automotive Applications

For over thirty years Allegro has been an IC supplier of choice for automotive manufacturers and sub-system suppliers worldwide. Allegro seeks to create value-added solutions for its automotive customers via merged-technologies. Extensive R&D resources are dedicated to the development and enhancement of automotive-specific processes enabling our engineers to incorporate Hall-effect sensing, logic, and power onto a single chip, in any combination, to meet each customer's unique system requirements. The results are ICs that achieve the highest levels of integration and are well matched to the rigorous quality and reliability demands of automotive applications.

AIRBAG / ABS / ACTIVE SUSPENSION

- Mixed Signal ASICs for Airbag Monitoring, Communication and Diagnostics
- Hall-effect Wheel Speed Sensors
- Hall-effect Height Position/ Steering Direction Sensors
- Fully-Protected Power IC Lamp and Inductive Load Drivers
- Mixed Signal ASICs for Signal Conditioning

INSTRUMENTATION

- Fully-Protected Power IC Lamp & Inductive Load Drivers
- AM/FM Stereo Decoders & Noise Blanker Signal Processing ICs
- H-Bridge Power ICs for HVAC & Gauge Control
- Hall-effect Window Position Sensors
- VF/LED Display Drivers

POWERTRAIN

- Hall-effect Crank/CAM Ignition Timing Sensors
- Fully-Protected Power IC Lamp and Inductive Load Drivers
- Hall-effect Transmission Speed Sensors
- Hall-effect Linear Throttle Position Sensors

To receive our NEW DATABOOK, call 1 (508) ALLEGRO or FAX your request to 1 (508) 853-7861.

THE PACE QUICKENS

Allegro™
MicroSystems, Inc.

Formerly Sprague Semiconductor Group

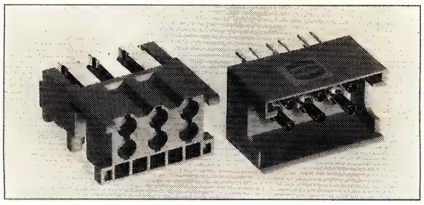
CALL 1 • 508 • ALLEGRO

115 Northeast Cutoff, Worcester, Massachusetts 01615

CIRCLE 254 FOR U.S. RESPONSE

CIRCLE 255 FOR RESPONSE OUTSIDE THE U.S.

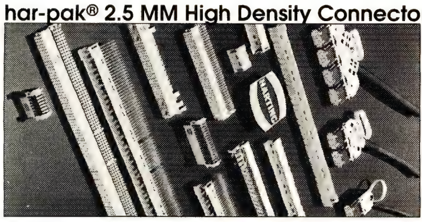
NEW HIGH DENSITY MICRO-COAXIAL CONTACTS



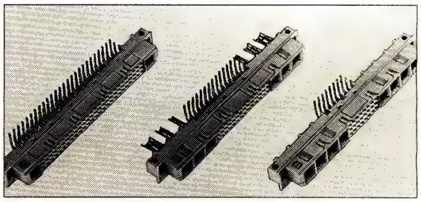
Designed for high speed data transfer rates. Can be used in the IEC 1076-4-2 2.5mm High Density connector system,har-pak®. Provides more space efficiency, high frequency capability, easy handling, low applied cost and application with current equipment practice and emerging metric equipment practices. Designed for PCB termination on both daughtercard to backplane connection;allowing users to bring signal directly into the backplane without a cable transition.

CIRCLE# 377

har-pak® 2.5 MM High Density Connector system Quasi-Coax-Contacts



har-pak has been developed for backplane and daughterboard applications in modern rack systems. The 5 row 2.5 mm connector design offers solderless PCB terminations, optimum utilization of space, three dimensional modularity, high contact density, EMI protection, and the ability to double-side surface mount components on daughter cards without loss of a 15 mm card pitch. The har-pak connector system allows the user to use a three dimensional 2.5 mm grid. With the exceptional capabilites of the connector,only one connector style is required to solve your power, signal, ground,and high data rates; simplifying the design and manufacturing of future systems.The compliant pin technology utillzes the same 1 mm plated through hole standard for many DIN 41 612 compliant pin technologies. The consistency in design uses the many years of manufacturing and design experience already available.These attributes combined can lead to new advancements n board-level designs: 15 mm card pitch with double-sided surface mounted daughter cards, butterfly or mid-plane techniques, modular design both horizontally and vertically,low number of system components, combination with other standardized packaging systems,and lower applied costs.**CIRCLE#378**



COMPLIANT PIN DIN 41612-TYPE M INVERSE CONNECTORS

HARTING'S compliant pin Inverse Type M DIN 41612 Eurocard connectors allowcontinued development of backplane technology using solderless termination and double-side surface mounting.

Applications include telecom, medical and high speed computers. Connector-cavities accommodate the DIN 41626 high voltage, power, coaxial or fiber optic contacts. Connector arrangements can accommodate 2 to 10 special purpose contacts and 78 to 6 standard contacts respectively.Compatible with HARTING male press-In tooling without modification, it can be delivered with special press-In Inserts to allow use of 'Flat Rock" or simple flatpress-in dies. **CIRCLE# 379**

'har-mik®', new miniature connectors from HARING ELEKTRONIK

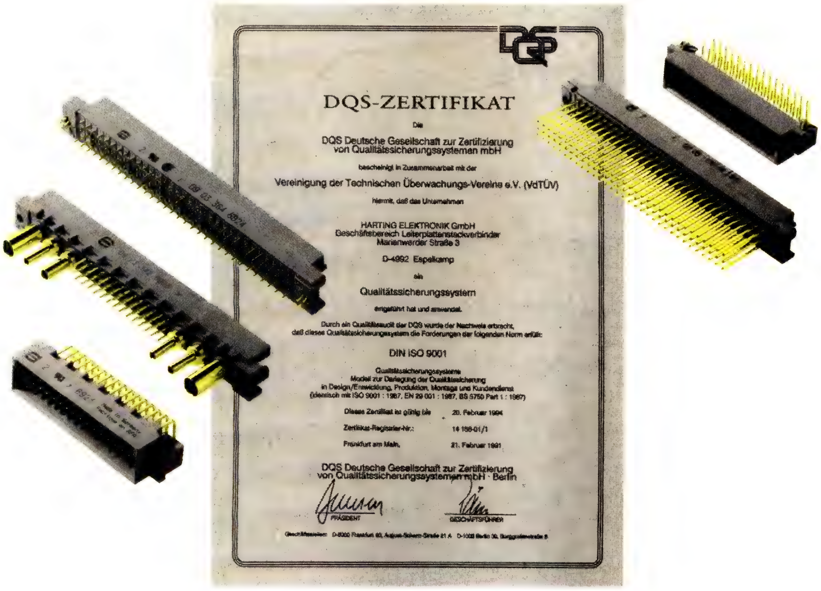
A new, comprehensive range of miniature connectors designed to meet the requirements of internal and external connections of the future has just been introduced by HARTING ELEKTRONIK, INC., The 'Pin and Socket' I/0 connectors. Serles 60.01/02/03/04.

Reduced size: contact pitch of 1,27 mm
High contact density: double standard D-Sub
E.M.I./R.F.I. protected. metal shells and hoods for optimum screening
Polarized by D shape
Coding: without contact loss
Locking device:
quick latch for S.C.S.I /RS 232 E applications.
Jackscrew for I.P.I/HI.P.P.I applications
Male and female IDC versions for discrete wire 28 to 30 AWG
Male and female connectors wth straight and angled solder pins
Many connector sizes: from 20 to 100 ways

Call (708) 519-7700, FAX: (708) 519-9771 or write HARTING ELEKTRONIKJ INC.2155 Stonington Avenue, Hof fman Estates, Illinois 6015-0710 for more Informaton.
CIRCLE#380

DIN connectors

The Oscar for quality



DQS-ZERTIFIKAT

Die
DQS Deutsche Gesellschaft zur Zertifizierung
von Qualitätssicherungssystemen mbH
bescheinigt in Zusammenarbeit mit der
Vereinigung der Technischen Überwachungs-Vereine e.V. (VdTÜV)
hiermit, daß das Unternehmen
HARTING ELEKTRONIK GmbH
Geschäftsbereich Leiterplattensteckverbinder
Marienwerder Straße 3
D-4992 Espelkamp
ein
Qualitätssicherungssystem
eingeführt hat und anwendet.
Durch ein Qualitätsaudit der DQS wurde der Nachweis erbracht,
daß dieses Qualitätssicherungssystem die Forderungen der folgenden Norm erfüllt:
DIN ISO 9001
Qualitätssicherungssysteme
Modell zur Darlegung der Qualitätssicherung
in Design/Entwicklung, Produktion, Montage und Kundendienst
(identisch mit ISO 9001 : 1987, EN 29 001 : 1987, BS 5750 Part 1 : 1987)
Dieses Zertifikat ist gültig bis 20. Februar 1994
Zertifikat-Register-Nr.: 14 156-01/1
Frankfurt am Main, 21. Februar 1991
DQS Deutsche Gesellschaft zur Zertifizierung
von Qualitätssicherungssystemen mbH · Berlin
PRÄSIDENT
GESCHÄFTSFÜHRER

DQS, the German QA System Certification Company, has awarded our PCB Connector Division the DIN ISO 9001 Certificate. This confirms our efforts to achieve perfection in both products and manufacturing methods.

HARTING is one of the first connector manufacturers in the world to be awarded this internationally recognised certificate of approval.

HARTING's worldwide recognition as a major connector manufacturer is founded not only on state-of-the-art production facilities, but also on an optimal system of quality assurance.

SEE US AT WESCON BOOTH 2660, 2662, 2664

Connectors from HARTING – the quality connection

HARTING

HARTING ELEKTRONIK, Inc. · 2155 Stonington Ave. · Suite 212
P.O. Box 95710 Hoffman Estates, Illinois 60195, U.S.A.
Phone 708 / 519-7700 · Fax 708 / 519-9771

WÄCHTER BREMEN

CIRCLE 124 FOR U.S. RESPONSE   **CIRCLE 125 FOR RESPONSE OUTSIDE THE U.S.**

PC GRAPHICS WATCH

INTERFACING AUDIO BOARDS

RICK ALLEN, MEDIA VISION INC.

As we head deeper into the 1990s, the PC multimedia revolution appears to be reaching full swing. As a result, sound cards, which were once considered toys, are now becoming standard PC equipment.

The PC's nascent audio period, circa 1981, consisted of simple beeps that came from their small, inexpensive embedded speakers. These were adequate for the relatively simple business applications that existed at the time. However, increasing popularity in games that used exotic sounds prompted a move to upgrade the PC's sound system.

Eventually, several hardware companies introduced PC-compatible audio boards. In 1987, Ad Lib Inc., Toronto, Canada, introduced an audio card, which gained widespread support by game suppliers. The board included an FM synthesizer for simulation of musical instruments and other sound effects. This was followed in 1989 by Creative Technologies Ltd. of Singapore, with its Sound Blaster audio card. By incorporating Ad Lib's FM-synthesizer design, the Sound Blaster board moved PC sound to a higher level by adding digital audio record and playback.

The latest wave of audio cards offer new advances, such as 16-bit digital audio and on-board digital-signal processors. However, the many varieties of audio products have made the task of developing drivers difficult for the software community. Unlike VGA controllers that supply a standard software interface through the VESA BIOS extensions, current PC audio applications must write directly to each card. Because of the many different audio implementations, software vendors have found it difficult to support each audio implementation. This has resulted in an industry without control of its own destiny. The software development industry—entertainment software in particular—has become the vehicle to drive the digital audio standards. And this burden has unwittingly fallen on the game developers.

To combat these obstacles, VESA developed a new specification, the VESA BIOS Extension/Audio Interface (VBE/AI), which defines a standard software-programming interface for PC audio hardware. The interface, which is in the form of low-level BIOS services, acts as an interpreter between the audio hardware and software applications using such hardware. The ultimate goal is to have VBE/AI hardware developers only write one hardware driver that conforms to the VBE/AI specification, and have it be compatible with all audio hardware. Likewise, software developers only will need to develop one universal driver that can support every new audio card entering the market.

The VBE/AI proposed interface is designed to support digital audio, MIDI, wave synthesis, FM, and other audio technologies. These technologies are grouped into three different low-level applications-programming interfaces, (APIs) which are accessed through the PC's ROM BIOS software interface. Actual implementation of the interface can be done as a ROM BIOS, DOS driver, TSR, or presented as a virtual interface to Windows or OS/2 audio services.

The three APIs are classified as digital audio—specifically Wave Audio, MIDI, and Volume services. The Wave Audio API is defined as a block-oriented interface. Standard PCM data sizes and formats provide compatibility across different operating systems. The MIDI API normalizes the method of using various synthesizers through a standardized approach to handle device-specific instrument patches, as well as the adoption of the general MIDI specification. The Volume API supplies stereo volume, tone, and filter control to the audio hardware. To allow for future hardware upgrades, an API call was included to control the audio channel in three-dimensional space. This is based on a spherical coordinate system.

When complete, the VBE/AI specification will enable PC audio software and hardware developers to minimize engineering efforts, which in turn reduces cost. In addition, hardware vendors supplying VBE/AI-compliant drivers will gain the necessary widespread support of multimedia and entertainment hardware and software that's available. Software developers, on the other hand, will be able to take advantage of the current and forthcoming audio technology without having to invest heavily in their engineering to support the potential growth in audio cards.

For further information about the VBE/AI specification or other issues, including graphics, multimedia, power-management, or software interfaces, contact the VESA office at (408) 435-0333.

Doug Cody, also of Media Vision, contributed to this column.

SYSTEM DESIGN NEWS

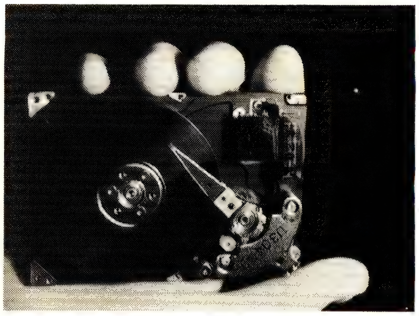
Capable of emulating all electrical and functional characteristics of an 8042-based keyboard controller, the UR6HCPCx keyboard controller family developed by USAR Systems Inc., New York, N.Y., also handles all levels of the keyboard BIOS protocol. As a result, the controllers can link off-the-shelf user input devices, such as keyboards, mice, trackballs, and bar-code scanners, to specialized or proprietary systems—without having to design new hardware, firmware, or complex software interface drivers. In addition, the controllers have jumper-selectable baud rates (up to 9600 bits/s) and are available with a full-duplex serial interface (UR6HCPCS), or a strobed, parallel-output port (UR6HCPCP). Other versions include the UR6HCPCH with a PC-to-HP-HIL interface, and those that can be custom defined.

Data that's sent from an input device can be delivered to the PC host system in either PC standard Scan Code format, or as translated and extended ASCII codes. If ASCII is selected, the chip interprets the status of the Lock and Shift keys and sends the proper ASCII codes. Many chip features are controlled via signals on various input pins. The chips also include an extended set of firmware-supported commands that can alter the functional characteristics dynamically, as well as provide error detection and recovery in high-reliability applications. Available in 40-lead DIPs or 44-lead PLCC or PQFPs, the keyboard circuits sell for $27.50 each in 100-unit lots. Contact John Milios at (212) 226-2042.

A still-video communications subsystem for PCs can capture monochrome or color images from camcorders, CAD programs, or scanners, and then transmit them to another PC over a telephone line in less than 35 seconds. Handy for working in real time on a shared image, the IMAGinE, designed by Interactive Image Solutions Inc., Colorado Springs, Colo., lets users communicate with arrow, text, or freehand annotations directly on an image. Requiring two telephone lines, one for image transfers and the other for voice, the video card runs in any 386 or 486 ISA-bus PC. The card includes a frame grabber to capture images, JPEG circuits to compress images, and photographic-quality (24-bit) color output. Input NTSC or PAL signals (composite or S-VHS) are digitized and converted into CCIR 601 (16-bit YCrCb 4:2:2 format) images at 640-by-480-pixel resolution. Included with the card is a 14,400-bit/s modem that's driven by an enhanced 8-bit serial card. With Windows-based software, users can do annotation; adjustments to hue, saturation, contrast, and brightness; image manipulation; and printing. The software handles JPEG, TIFF, TARGA, GIF, and BMP file formats, and includes drivers for color and laser printers. The video card, serial card, modem, and software packaged together goes for $2495 per node. At least two nodes are needed for bidirectional communications. Contact Rick Cooper at (719) 598-3894.

A standardized BIOS dubbed the SurePath PC Standard (SPCS), which is the result of a joint venture between IBM Corp., Armonk, N.Y., and Phoenix Technologies Ltd., Norwood, Mass., specifies the external interfaces of the BIOS and some aspects of the motherboard hardware. The SPCS defines the appropriate software standard interfaces for calling hardware functions. It supports X86-compatible microprocessors from AMD, Cyrix, IBM, and Intel. Because the SPCS is operating-system independent, it eliminates the guesswork associated with BIOS calls. SurePath BIOS licensees also receive IBM verification tools to test PC compatibility. The two companies plan to extend the BIOS architecture to incorporate support for emerging technologies that need BIOS access to function properly. Such technologies include Peripheral Component Interconnect (PCI) local-bus designs, PCMCIA-compliant cards, the EISA architecture, and power-management for portable and desktop (green) PCs. Call Phoenix at (617) 551-4000.

▼ 2.5-IN. HARD DRIVES USE MR TECHNOLOGY



A family of 2.5-in. hard-disk drives uses a magneto-resistive (MR) head technology to boost performance and capacity. The low-profile drives offer an average areal density of 322 Mbits/in.^{2}. As a result, the number of heads and platters are reduced, which increases the drives' MTBF to 300,000 hours. Capacities of the low-profile (17-mm) drives range from 172 to 344 Mbytes. They're available now with either AT or SCSI interfaces. Evaluation prices for the 172-, 258-, and 344-Mbytes drives are $300, $400, and $459, respectively.

IBM Corp.
1133 Westchester Ave.
White Plains, NY 10604
▶CIRCLE 541

▼ 186-BASED BOARD BOASTS HIGH INTEGRATION

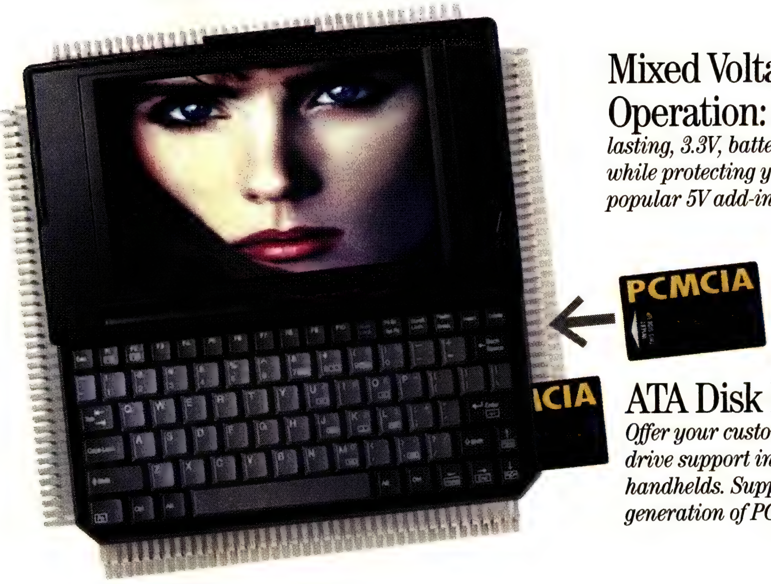
Designed to replace multiple cards, the Magnum-C186EB busless computer board includes most common I/O functions on board. Suited for embedded applications, the 16-bit CPU board is built with an 80C186EB processor and an optional 80C187 coprocessor, both running at 16 MHz. A total of 1 Mbyte of on-board memory can be either SRAM, EPROM, flash EPROM, or battery-backed SRAM. Other features include an integrated interrupt controller, five 16-bit counter-timers, four serial ports, and four iSBX expansion ports for customization. Device drivers, startup code, and demonstration programs are included. The 16-MHz Magnum-C186EB sells for $789. An 8-MHz version costs $749. Options include connector kits, mounting hardware, and a desktop power supply.

R.L.C. Enterprises
4800 Templeton Rd.
Atascadero, CA 93422
(805) 466-9717
▶CIRCLE 542

Featuring:

Single-Chip Host Adapter Solution: *Complete PCMCIA/ISA bus interface eliminates the need for external buffers. Saves board space for other marketable features.*

Power Saving Modes: *Advanced, on-chip power features save battery life.*



Mixed Voltage Operation: *Design in a longer-lasting, 3.3V, battery-operated system while protecting your investment in popular 5V add-in cards.*

ATA Disk Interface: *Offer your customers hard disk drive support in portables and handhelds. Supports the new generation of PCMCIA drives.*

Exceptional value for the PCMCIA standard... FeatureChips™ Controllers.

PCMCIA compatibility is in the cards for fast-selling portables. But getting PCMCIA on your motherboard doesn't have to gobble up precious space and design-in time. Just design in a single-chip Cirrus Logic *FeatureChips* host adapter solution.

By reserving a small area for our high-integration 1- or 2-socket PCMCIA adapters, you'll build in many high-demand features: Intel 82365SL compatibility, ExCA™ compatibility, programmable timing, independent multiple sockets (2-socket controller), ATA and IDE interfaces, and more.

And, since these adapters are PCMCIA 2.0 and JEIDA 4.1-compliant, you're ensuring present and future compatibility.

In addition to host adapters, we are developing a full family of controllers for your PCMCIA add-in card requirements.

Cirrus Logic *FeatureChips*™ controllers – they're designed to help your products prosper in the marketplace. Call today to learn how to plug them into your current design plans.

Free *FeatureChips* Literature Hotline:
1-800-858-0487* Ask for dept. L35

*In Japan (81) 3-5389-5300. Singapore (65) 3532122. Taiwan (886) 2-718-4533. Germany (49) 8152-2030. United Kingdom (44) 0727-872424. © 1993 Cirrus Logic, Inc. 3100 West Warren Avenue, Fremont, CA 94538. (510) 623-8300. The Cirrus Logic logo is a registered trademark and FeatureChips is a trademark of Cirrus Logic, Inc. ExCA is a trademark of Intel Corporation.

CIRRUS LOGIC®
FEATURECHIPS™

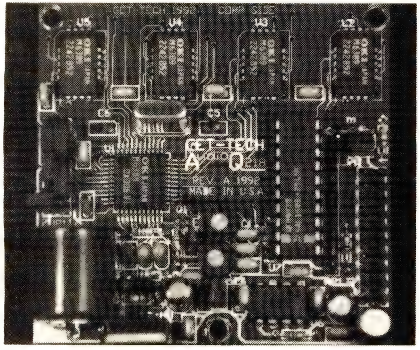
▼ WRITE CACHE IMPROVES DRIVE PERFORMANCE

The Bernoulli MultiDisk 150, a removable-storage device, has been enhanced using a write cache. The company says that with the electronic buffer, the system can save data up to three times faster. The 256-kbyte buffer raises performance, which stands at an 18-ms access time and a 5-Mbyte/s burst transfer rate. The 150-Mbyte drive is backward-compatible with earlier data cartridges of 35, 65, and 105 Mbytes. Prices for the drive start at $1099. The 150-Mbyte data cartridge sells for $225.

Iomega Corp.
1821 W. 4000 S.
Roy, UT 84067
(801) 778-1000
▶CIRCLE 543

▼ RECORDER HOLDS 218 SECONDS OF SPEECH

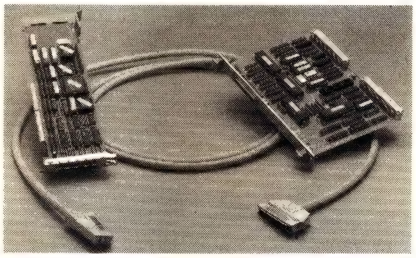
Able to record up to 218 seconds of speech, the AudioQ-218 supplies four selectable sample rates: 4.8, 8.5, 9.6, and 11 kHz. Two independent adjustable outputs are offered. One can drive an 8-Ω speaker up to 400 mW; the other can be used to send a signal to an external amplifier or transmitter. An on-board regulator permits a supply voltage ranging from 8 to 15 V dc. In addition, an open-collector output can be used to key a transmitter or external device during playback. The 2.6-by-2.6-in. unit comes with 4 Mbytes of RAM and sells for $149.



GetTech Inc.
402 Riley Rd.
New Windsor, NY 12553
(914) 564-5347
▶CIRCLE 544

▼ MICRO CHANNEL SYSTEM CONTROLS VME CHASSIS

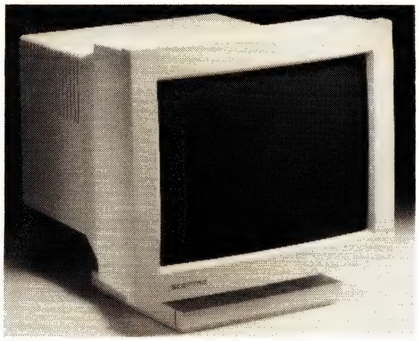
Using the VMIMCN-5521L VMEbus-to-Micro Channel (MCA) adapter, a 32-bit Micro Channel-based system can function as a VMEbus master that controls an external VME chassis. Or, if the adapter is placed in slot one of the VMEbus, the MCA system can function as the only master in the chassis. Data transfers of 8, 16, and 32 bits are supported. All single MCA bus cycles to the memory area mapped by the MCA interface slave board are repeated to the memory-mapped cycles in the VME chassis. VMEbus interrupts are individually user-configurable to be handled by the workstation CPU or by a local VMEbus CPU. The board occupies 128 Mbytes of contiguous MCA memory space, which can be mapped into any VME bus address space. All seven VME interrupt levels can be monitored and translated into up to seven Micro Channel interrupt requests. The VMIMCN-5521L is available now for $1695. Large-quantity and OEM discounts apply.



VMIC
12090 S. Memorial Pkwy.
Huntsville, AL 35803
(205) 880-0444
▶CIRCLE 545

▼ 17-IN. MONITOR EMITS LOW RADIATION

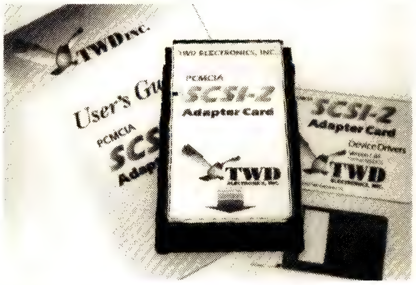
The CL-617L 17-in. color monitor was built to conform with the Swedish MPR II low-radiation standards. It also features a narrow footprint, thus it requires less desk space. The monitor limits extremely low-frequency (ELF) and very low-frequency (VLF) radiation to reduce any possible health risks associated with CRTs. A flicker-free 72-Hz refresh rate with a VESA-approved display resolution of 1024 by 768 pixels results in comfortable viewing. A maximum noninterlaced resolution of 1280 by 1024 pixels can be displayed with a continuous multiscan frequency of 30 to 66 kHz. Front-edge, pushbutton controls make it possible to adjust horizontal and vertical size and screen positions by 50%. The CL-617L sells for $1495.



Sceptre Technologies Inc.
560 S. Melrose St.
Placentia, CA 92670
(714) 993-9193
▶CIRCLE 546

▼ PLUG SCSI II DEVICES INTO PCMCIA SLOT

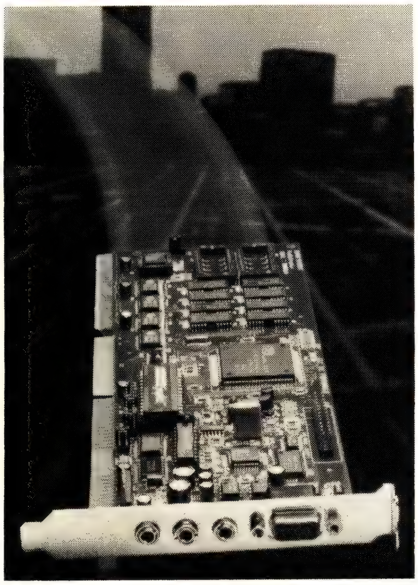
Because SCSI-based peripherals and laptop computers are both becoming increasingly popular, it became apparent that two must be made to fit together. That need has been filled by SCSI II adapter card Model 2001, which lets the peripherals plug into a laptop's (or any other system's) PCMCIA slot. The types of peripherals include hard-disk, CD-ROM, and tape drives, as well as communication and multimedia devices. The card supports 8-bit transfers of up to 3 Mbytes/s on the SCSI bus with concurrent 16-bit transfers on the PCMCIA bus. Standard DOS drivers come with the card. SCSI terminators can be disabled through software. In addition, a sleep mode helps to reduce the card's power draw. The Model 2001 sells for $285; the card by itself sells for $225. Large-quantity discounts are available. Volume production will commence in the fourth quarter.



TWD Electronics Inc.
1800 Constellation Dr.
P.O. Box 38384
Colorado Springs, CO 80937
(719) 634-8187
▶CIRCLE 547

▼ VL-BUS BOARD HANDLES AUDIO AND VIDEO

The AudioGraphix multimedia board combines a 24-bit true-color graphics accelerator with a 16-bit record-and-playback sound card. It plugs into the VL-Bus local bus connector and offers sound performance compatible with Sound Blaster, Ad Lib, and the Windows Sound System. High-quality sampling is available at rates of 4 to 22.05 kHz.



Based on a Cirrus Logic GD5426 GUI accelerator, the graphics portion of the board delivers a maximum display resolution of 1280 by 1024 pixels. The card comes standard with 1 Mbyte of DRAM, but can hold up to 2 Mbytes. The AudioGraphix is available now for $299.

Genoa Systems Corp.
75 East Trimble Rd.
San Jose, CA 95131
(408) 432-9090
▶ CIRCLE 548

▼ SPARC BOARD SUITS EMBEDDED APPLICATIONS

The TP91 microSparc-based embedded processor board supports the Solaris operating system as well as the LynxOS and VxWorks real-time operating systems. The board combines the 50-MHz RISC processor with memory, flexible I/O options, and expansion interfaces for standalone embedded applications such as factory-floor controllers, telecom equipment, and office-automation products. For maximum customization, the board offers four SBus slots. The memory bus is connected to four SIMM sockets that can hold up to 128 Mbytes of 60-ns DRAM through a 64-bit interface. The onboard slave I/O device houses an interrupt controller, a four-way serial controller, and a floppy-disk controller. Available now, the TP91 sells for $1995 with 8 Mbytes of DRAM. Large-quantity discounts are available.

Tadpole Technology Inc.
12012 Technology Blvd.
Austin, TX 78727
(512) 219-2200
▶ CIRCLE 549

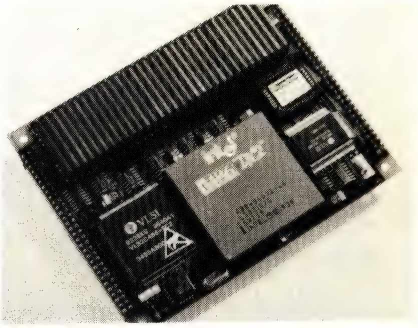
▼ KIT SIMPLIFIES KEYBOARD EVALUATION

Designers can now assess a Fujitsu production keyboard using the company's evaluation kit. The kit includes a keyboard, an evaluator board that contains a keyboard controller-encoder IC, all appropriate cables and connectors, and documentation. The controller-encoder IC supports power-management techniques, LED drivers, and user-programmable key remapping. It's available in surface-mount, DIP, PLCC, and QFP packages. The IBM-compatible keyboard features a full-travel, 3-mm stroke with a quiet tactile feel. The minimum operational life is 10 million keystrokes. The evaluation kits are available now for $125.

Fujitsu Microelectronics Inc.
3545 N. First St.
San Jose, CA 95134
(408) 922-9000
▶ CIRCLE 550

▼ TINY CPU MODULES FIT EMBEDDED SYSTEMS

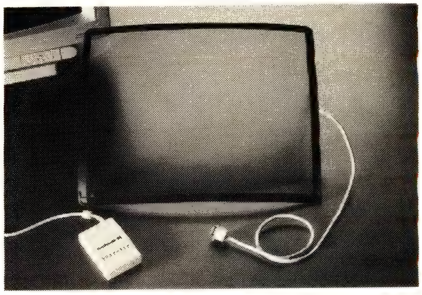
Designed for embedded PC systems, the ModulAT family of interchangeable CPU modules range from a 9.54-MHz 8088 to a 66-MHz 80486DX2. The modules come with the processor, system core logic, 64 kbytes to 16 Mbytes of DRAM, a real-time clock, BIOS, a keyboard interface, and an optional math coprocessor. The 4.8-by-3.8-in. cards all comply to a similar system bus architecture. As a result, when performance upgrades are necessary, a higher-performance module can be swapped in. Prices for the ModulAT cards range from $345 to $2500.



RFM Inc.
25 Mauchly, Suite 309
Irvine, CA 92718
(714) 453-1822
▶ CIRCLE 551

▼ TURN DISPLAY INTO TOUCHSCREEN DEVICE

Mounted to the back or bottom of a CRT, the SMT-1 controller can turn a display into a touchscreen device. The pocket-sized part fits in a small (3.75 by 2.5 by 0.9 in.) plastic box. Previously, touchscreen kits required a controller board inside the host system, a serial controller inside the display, and a power supply. Power for the SMT-1 is obtained from the monitor's power supply, the PC's keyboard port, or from a wall-mount supply. The device's MTBF stands at 572,600 hours. An external LED is used for diagnostics. The SMT-1 sells for $318, with large-quantity discounts available.



MicroTouch Systems Inc.
300 Griffin Park
Methuen, MA 01844
(508) 659-9000
▶ CIRCLE 552

Such simplicity and breadth!

With this one compact system, you enjoy complete E-field monitoring capability up to 40 GHz, for fields from one to 300 volts per meter.

Inside your shielded room: A probe with frequency response from 10 kHz to 1 GHz (enough bandwidth for 82% of susceptibility-test applications); and another probe with a range from 80 MHz to 40 GHz. Both probes have rechargeable batteries for operation up to 40 hours.

Outside the shielded room, connected through glass fiberoptic cables that can carry signals as far as 1,000 meters, is the remarkable new FM2000 monitor — offering you total flexibility for measuring and leveling fields around the EUT.

The FM2000 accommodates up to four probes of either or both frequency ranges, for placement at various locations in the shielded room. Each probe delivers its own signals through an input card to the control console, and you can select HI/LO/AVG readings from multiple probes at the touch of a finger on the keypad. Outputs are provided to IEEE-488 and RS-232 interfaces and 0-4 Vdc, giving you the widest choice for automatic field control — plus audible signal and SPDT contact closure for excessive-field-level or low-battery alarm.

With European and American immunity requirements increasing daily, you need a reliable ultra-broadband field-monitoring system, available from stock now, for your susceptibility testing. Get all the technical data you need on the FM2000 system. One of our applications engineers will pick up the phone himself when you call, toll-free, **1-800-933-8181**.

84-inch probe stand (easily cut to lower height) lets you position probes where you want them. One screw clamp included with each stand, additional clamps available.

ar AMPLIFIER RESEARCH

160 School House Road
Souderton, PA 18964-9990 USA
Phone 215-723-8181. Fax 215-723-5688

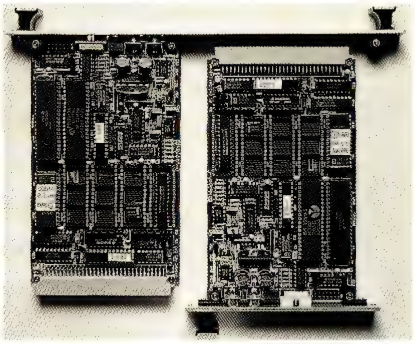
For engineering assistance, sales, and service throughout Europe, call EMV: *Munich, 089-612-8054; London, 0908-566556; Paris, 1-64-61-63-29*

6313

CIRCLE 86

▼ ADD AUDIO CAPABILITY TO VME SYSTEM

Available in either a 3U or 6U format, the MA550 is a single-slot board that adds voice capabilities to a VME system. On-board microprocessor and multitasking voice-processing-monitor (VPM) firmware allow for simultaneous voice output, communication with the VMEbus CPU card, and control functions using the card's serial or I2C bus I/O. The card contains four memory sockets, each holding an 8-Mbit RAM, EPROM, or EEPROM chip, for up to 3 min. of recording or playback at a 10-kHz bandwidth. The MA550 voice-processing board costs $360.



Microcontrol Pty. Ltd.
28 Selwyn St.
Pymble, NSW 2073, Australia
(02) 449 1546
▶ **CIRCLE 553**

▼ MODEMS COME IN TINY PACKAGES

Packages for high-speed fax-modems are shrinking rapidly. According to Rockwell International, none is smaller than the V.Fast Class family, which support data rates from 19.2 to 28.8 kbits/s. The modems include probing and multidimensional trellis coding, which permits the high speed and increases transmission reliability. The data-pump versions are pin-for-pin compatible with the company's current V.32 offerings (in a 68-pin PLCC), easing design migration. Controller firmware performs all basic modem functions, including the enhanced AT commands. Prices, in quantities of 10,000, start at $72.

Rockwell International Corp.
4311 Jamboree Rd.
P.O. Box C
Newport Beach, CA 92658
(800) 436-9988 or
(818) 365-1876
▶ **CIRCLE 554**

HALF-SIZED PC BOARD INTEGRATES A PHONE, VOICE-MAIL SYSTEM, SOUND BOARD, AND DATA AND FAX MODEMS USING THE MWAVE DSP CHIP.

DSP BOARD COMBINES MULTIPLE PERIPHERALS

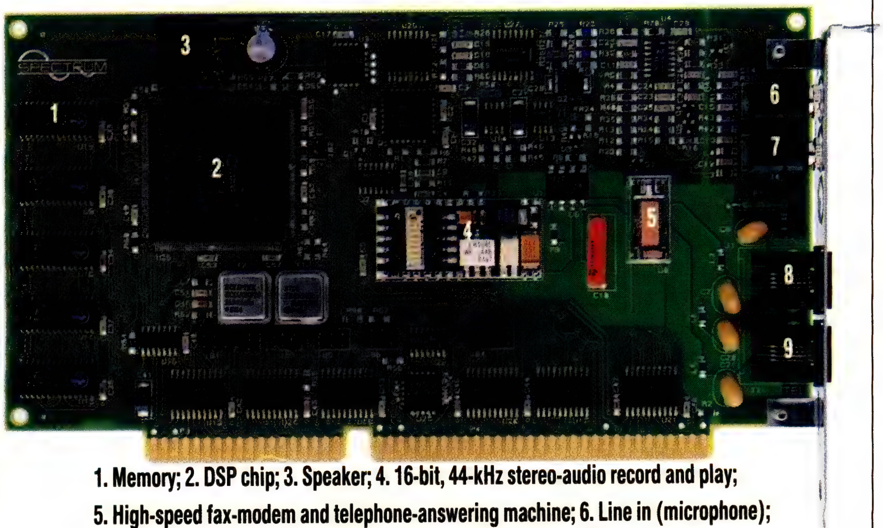
RICHARD NASS

Fax modems with data rates as high as 9600 and 14,400 bits/s are readily available as plug-in board-level products. The same can be said for telephone answering machines and 8- and 16-bit audio boards. Now, however, users can avail themselves of all these functions from a single PC-compatible board thanks to DSP technology.

The OfficeComm board developed by Spectrum Signal Processing Inc. uses a Texas Instruments TMS320500 DSP chip to perform all of those functions *(see the figure)*. The microprocessor was actually designed by IBM and marketed by TI as the Mwave digital-signal processor.

With a DSP-based solution, users can reprogram the processor for future performance upgrades. For example, if the board shipped with a 9600-baud modem, users could easily upgrade later through software to 14,400-baud performance.

Noise cancellation is another feature that directly results from a DSP-based solution. This feature can be used even for subtle noise, such as that generated by a PC's fans. Essentially, the DSP circuit listens to the ambient noise, then generates an acoustic signal that's exactly the opposite phase of



1. Memory; 2. DSP chip; 3. Speaker; 4. 16-bit, 44-kHz stereo-audio record and play;
5. High-speed fax-modem and telephone-answering machine; 6. Line in (microphone);
7. Line out (headphones or speakers); 8. Telephone-line out; 9. Telephone-line in.

THE FUNCTIONALITY OF FAX and data modems, a full-function answering machine, and a 16-bit sound board are all combined on the OfficeComm add-in card. The heart of the half-sized PC-compatible board is a TI Mwave TMS320500 DSP chip.

the ambient noise. The two sounds then cancel each other out. It can distinguish between background noise and primary voices using a low-pass filter that averages the sound over time. Typically, the background is steady and constant.

CPU INDEPENDENT

By having the DSP IC handle tasks independently of the host CPU, the OfficeComm board will always run at peak efficiency. The entire PC is at the user's disposal because all OfficeComm functions operate in the background. The board's local operating system is a full real-time multitasking OS. Consequently, the modem can be sending or receiving information while sound files are playing, and all of the host CPU's resources remain at the user's disposal.

Putting every peripheral onto one half-sized board removes the incompatibility problems that sometimes occur between devices. It also eliminates a switching device that's required for telephone functions. Typically, to keep a fax machine, a modem, a voice-recording answering machine, and a live telephone all on one telephone line would require a switching box that could distinguish between the different types of incoming calls and route them to the proper place.

The board was designed from the onset to function as an office-productivity tool. It can digitize and compress incoming voice messages on-the-fly to conserve memory space. The voice function is built with an 8-bit μ-law converter, providing sound quality that's analogous to a 12- or 14-bit monotone system.

The DSP circuit on the OfficeComm lets it act as a complete communications manager, performing any functions that the regional telephone-line carrier offers, such as call forwarding, call waiting, three-way calling, etc. It can also perform ring discrimination by detecting if an incoming call contains a voice or data (for the fax or modem). Furthermore, it's able to determine if a particular incoming call is on the line, before it goes off-hook, similar to today's Caller ID function. The difference is that the DSP circuit monitors the ring and looks at the duty cycle that exists between rings; Caller ID processes the information sent between rings.

As a voice-mail-based answering machine, the system can log all incoming and outgoing calls, and use customized messages. The board, which can be plugged directly into a live telephone line, includes a jack for an external telephone. The telephone can also act as an I/O device by listening to or recording telephone messages and sound bytes embedded within documents. The board contains an internal four-pin connector for CD-ROM audio, which is played through the board.

Unlike most speaker phones, the OfficeComm offers hands-free full-duplex operation. Most speaker phones aren't truly full-duplex machines—the party speaking into the speaker phone can't be interrupted at the other end because of feedback problems caused by the telephone's microphone and speaker working simultaneously.

To eliminate this feedback problem, the OfficeComm attenuates the microphone input when it detects a signal at the speaker, a feature handled by the DSP circuit. Such a feature is available in other full-duplex speaker phones (usually DSP-based), but they're quite expensive, costing upwards of $1000.

LOCAL-MEMORY OPERATION

The board includes 32 kbits by 24 bits of high-speed SRAM. This local memory performs such operations as sound synthesis and also holds the programs for the modem and fax. Rapid communications between the OfficeComm board and the PC is assured by a DMA channel, with a cycle-request time of 1 or 4 μs, that's built into the Mwave DSP chip. Memory-intensive operations can be handled by the PC's system memory.

A full V.32bis (14.4-kbaud) modem, featuring MNP error correction and data compression as well as a V.29 fax (9.6 kbaud), is incorporated on the OfficeComm. Both the fax and data modems can fall back to slower modes. Upgrade software probably will be available before the end of this year. Using the fax features, a document that combines text and graphics can be sent directly from the host PC without generating a hard copy. Likewise, incoming faxes can be viewed on-screen without printing out a hard copy.

LISTEN WITH SPEAKERS

A 1/8-in. stereo microphone input and an audio output (32 Ω or greater) are fixed on the board. An 8-Ω low-power speaker can be driven with 0.25 to 0.5 W of power. A small speaker is embedded for using the fax modem, eliminating the need for external speakers. However, sound bytes that are captured and embedded into existing software applications, such as a word-processing document or a spreadsheet, should be heard on amplified external speakers.

The board connects through the system's ISA bus. A future generation might be based on a local-bus interface, thereby increasing the bandwidth between the board and host CPU. This may become essential in the future, because the number of communications going across the bus could grow once new, software-upgradable, applications arrive.

The DSP circuit also will be able to handle voice recognition, a feature that's expected in the board's next generation or as an upgrade to the current OfficeComm board. Other developments coming sometime in the future include: converting speech into ASCII text, color fax, higher-speed modems, and voice and image compression. According to the company, the Mwave DSP chip is powerful enough to handle these future functions.☐

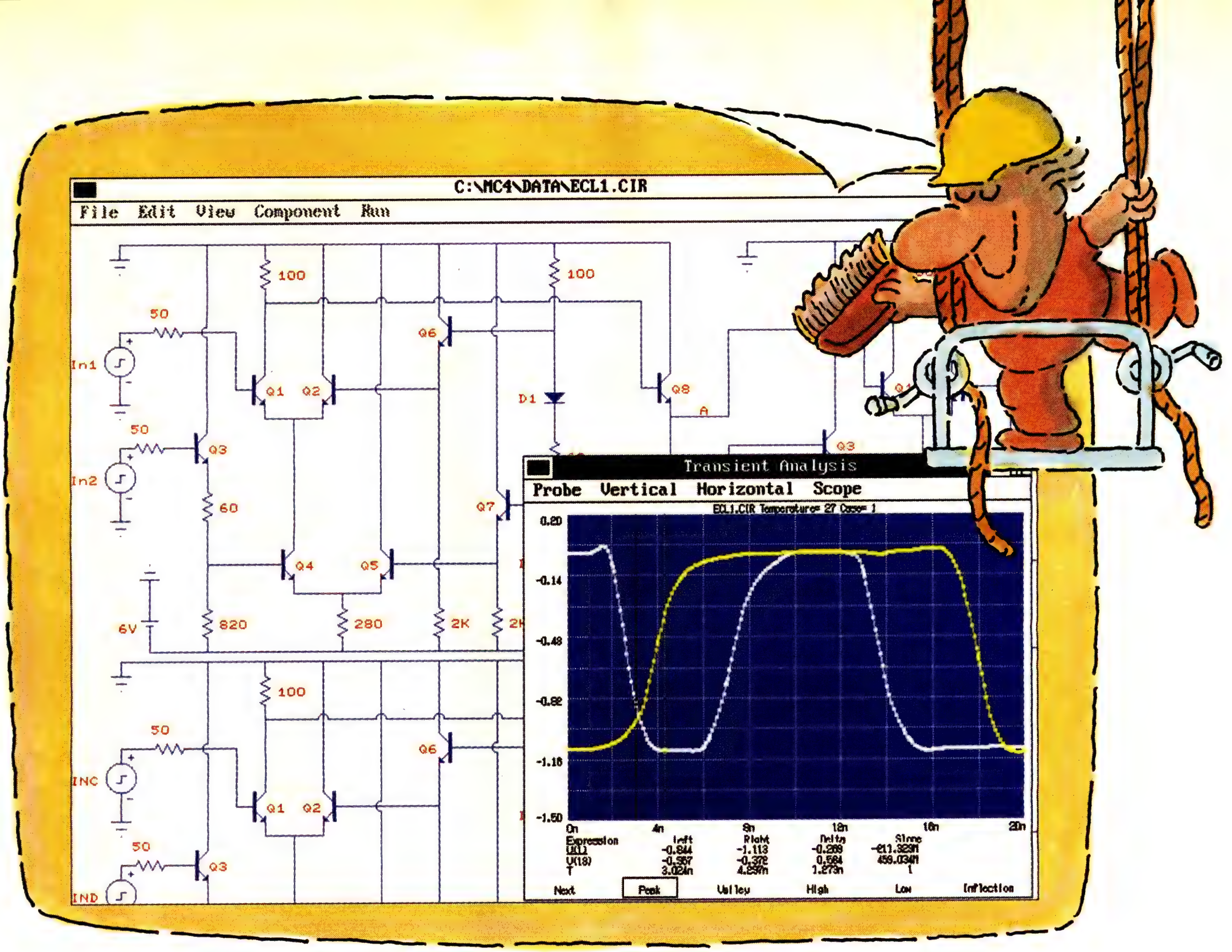
PRICE AND AVAILABILITY

The OfficeComm board is sampling now; production is expected to commence in the fourth quarter. The board will sell for $195 each in OEM quantities. Minimum system requirements are a 386SX-based PC and Microsoft Windows 3.1. The board is available bundled with the applications for end users, or without the applications for OEMs that want to bundle their own.

Spectrum Signal Processing Inc., 8525 Baxter Pl., 100 Production Ct., Burnaby, British Columbia V5A 4V7; (604) 421-5422.

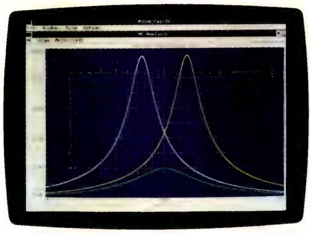
CIRCLE 520

HOW VALUABLE?	CIRCLE
HIGHLY	587
MODERATELY	588
SLIGHTLY	589



```
Expression        Left       Right      Delta       Slope
V(1)             -0.844     -1.113     -0.269    -211.329M
V(18)            -0.567     -0.372      0.584     459.034M
T                 3.024n     4.297n     1.273n    1
```

INTRODUCING MICRO-CAP IV.™ MORE SPICE. MORE SPEED. MORE CIRCUIT.


AC Analysis

PC-based circuit analysis just became faster. More powerful. And a lot easier. Because MICRO-CAP IV is here. And it continues a 12-year tradition of setting CAE price/performance standards.

Put our 386/486 MICRO-CAP IV to work, and you'll quickly streamline circuit creation, simulation and edit-simulate cycles — on circuits as large as 10,000 nodes. In fact, even our 286 version delivers a quantum leap upward in speed. Because, for one thing, MICRO-CAP IV ends SPICE-file-related slowdowns; it reads, writes and analyzes SPICE text files and MC4 schematic files. It also features fully integrated schematic and text editors. Plus an interactive graphical interface — windows, pull-down menus, mouse support, on-line HELP and documentation — that boosts speed even higher.

Now sample MICRO-CAP IV power. It comes, for example, from SPICE 2G.6 models plus extensions. Comprehensive analog behavioral modeling capabilities. A massive model library. Instant feedback plotting from real-time waveform displays. Direct schematic waveform probing. Support for both Super and Extended VGA.

And the best is still less. At $2495, MICRO-CAP outperforms comparable PC-based analog simulators — even those $5000+ packages — with power to spare. Further, it's available for Macintosh as well as for IBM PCs. Write or call for a brochure and demo disk. And experience firsthand added SPICE and higher speed — on larger circuits.

spectrum

1021 S. Wolfe Road
Sunnyvale, CA 94086
(408) 738-4387 FAX (408) 738-4702

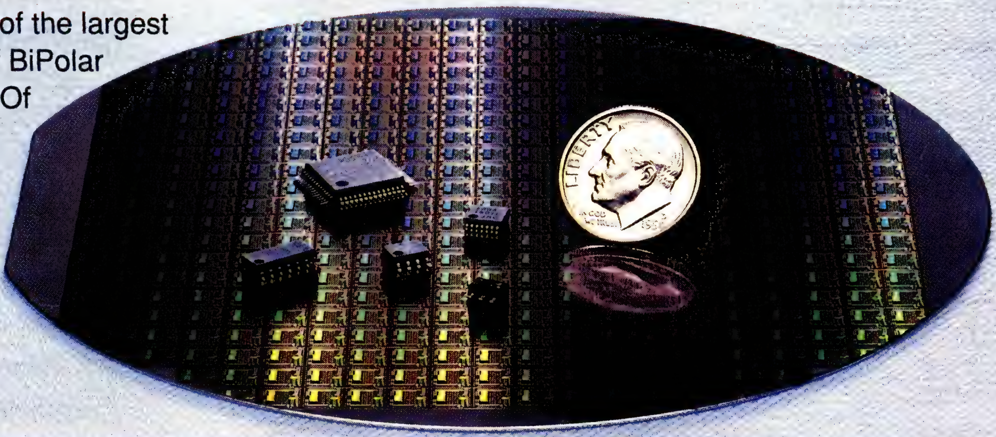
CIRCLE 293 FOR U.S. RESPONSE CIRCLE 294 FOR RESPONSE OUTSIDE THE U.S.

New JRC

The leader in BiPolar and CMOS IC's

World's Best Selling Surface Mount Linear IC's

New JRC is one of the largest manufacturers of BiPolar and CMOS IC's. Of over 100 million produced each month, surface mount devices represent 80% of the total.



MICROPROCESSOR PERIPHERAL C-MOS IC'S

PART NO.	DESCRIPTION	PACKAGE
NJU6355	Serial Interface Real Time Clock for 4-bit CPU	D, M8
NJU3711	8-bit Serial In Parallel Out	D, M14
NJU3712	8-bit Serial In Parallel Out with Cascade Function	D, M16
NJU3713	12-bit Serial In Parallel Out	D, G18
NJU3714	12-bit Serial In Parallel Out with Cascade Function	D, G20
NJU3715	16-bit Serial In Parallel Out	L, G22
NJU3716	16-bit Serial In Parallel Out with Cascade Function	L, DMP24
NJU3718	20-bit Serial In Parallel Out with Cascade Function	L, G28
NJU3719	24-bit Serial In Parallel Out	L15

All New JRC BiPolar and CMOS IC's are available in Surface Mount and Thru-Hole Packages.

- ★ ***Representatives are wanted in: Illinois, Pennsylvania and Colorado***
- ★ ***Distributors wanted throughout the United States.***

For additional information or to request samples, please call NJR at (415) 961-3901 or our Representative in your area. NJR Representatives are located throughout the USA and Canada.

JRC

NJR CORPORATION
A Subsidiary of New Japan Radio Company, Ltd.
340-B East Middlefield Rd.
Mountain View, CA 94043 U.S.A.
Tel: 415-961-3901 • Fax: 415-969-1409

CIRCLE 284 FOR U.S. RESPONSE
CIRCLE 285 FOR RESPONSE OUTSIDE THE U.S.

LOGIC SCOPE SIMPLIFIES DIGITAL CIRCUIT DEBUG

A Logic Analyzer And High-Performance DSO Combined In One Instrument Makes Life Easier For Digital Designers.

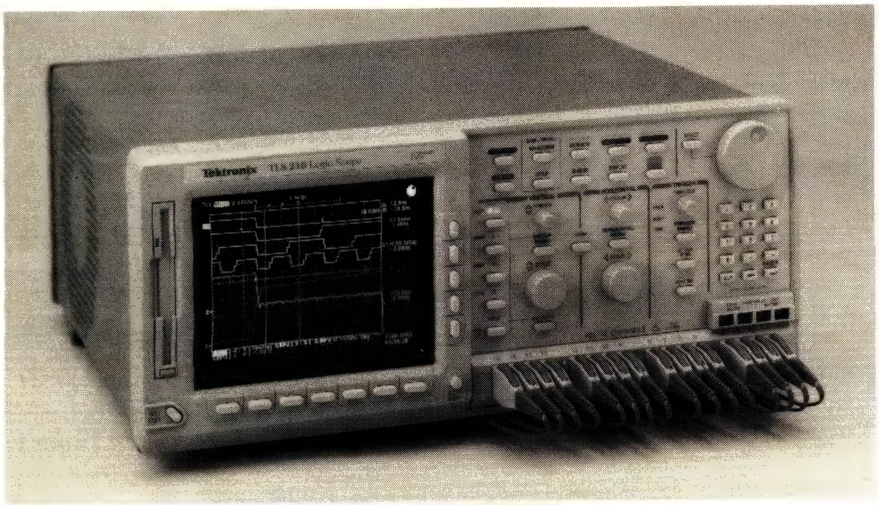
John Novellino

As much as they'd like to, many digital designers can no longer ignore the analog characteristics of their digital signals. At the higher operating speeds that have become an everyday occurrence, problems such as crosstalk, overshoot, undershoot, and reflections are provoking timing violations. The best tool for troubleshooting these problems is a digital storage oscilloscope (DSO), which displays the signal's analog characteristics, not just the 1-bit logic-high or logic-low presentation of a logic analyzer. But DSOs are limited to two or four channels, too few for efficient digital troubleshooting, and they typically lack the advanced triggering capability of logic analyzers.

As a result, designers often must use both instruments—a DSO and a logic analyzer—to verify and debug a digital system. That means double probing some pins, a difficult task considering that the increasingly common surface-mount and fine-pitch ICs are hard enough to single probe with a typical oscilloscope probe. Then the designer must link the two instruments together so that they can cross-trigger each other. In the end, there's still two sets of controls to adjust and two displays to watch.

This unsatisfactory solution can be remedied by the Tektronix TLS 216 Logic Scope, which combines the analog acquisition system of a high-performance DSO with the triggering and display flexibility of a logic analyzer *(Fig. 1)*. The TLS 216 offers no-compromise performance as a DSO: a 2-GHz sample rate across 16 input channels, a 500-MHz real-time bandwidth, and 8-bit vertical resolution.

As a logic analyzer, the instrument delivers a 100-ps timing resolution across all 16 channels, the equivalent of an analyzer with a 10-Gsample/s sampling rate. Such fine resolution is made possible by using an interpolation algorithm, which is a technique common on DSOs but not found on logic analyzers. The Logic Scope can acquire signals with edge speeds as fast as 700 ps, whether single-shot or repetitive, without noticeable distortion.



1. THE 16-CHANNEL TLS 216 COMBINES the analog acquisition system of a DSO with the triggering and display systems of a logic analyzer.

These specifications are backed up by an advanced trigger capability that allows the unit to trigger on common digital behavior. In addition to edge, pulse, glitch, and pattern triggering, the TLS 216 provides two new types of triggers. A time-interval or sequence trigger monitors the time between two events. The designer can specify valid operating ranges for specifications like setup or hold times so that the unit can trigger on setup- and hold-time violations. This trigger can also detect an unexpected propagation delay. And a unique "time-out" trigger monitors a handshake or other sequence and triggers if the sequence takes too long or never completes.

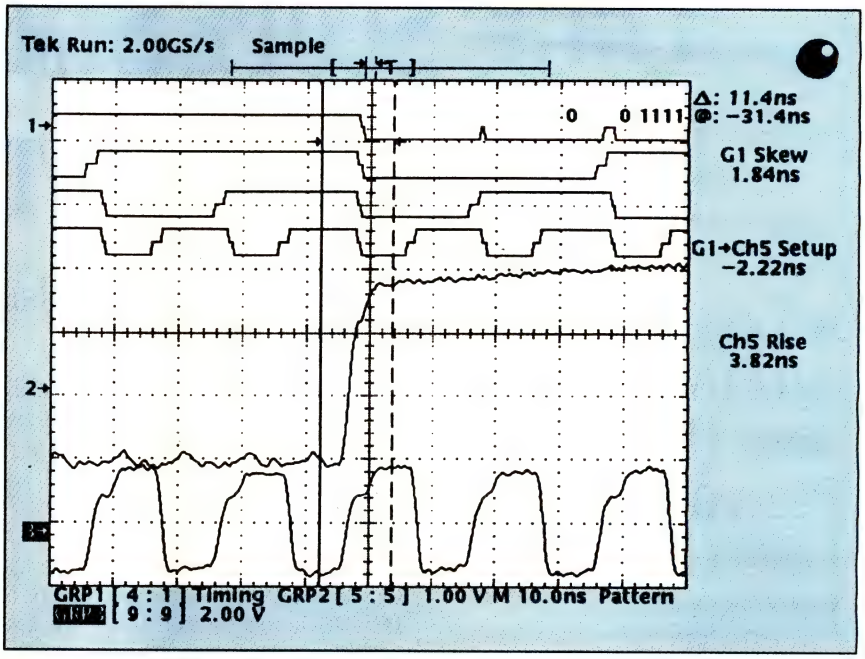
Thus, designers can identify channel-to-channel relationships, including 16-bit patterns and time-related or time-qualified system faults. An external-trigger capability enhances cross-triggering, making it easier to use the Logic Scope with other test instruments.

Tektronix solved the problem of probing surface-mount and fine-pitch devices, many of which have lead spacing smaller than the traditional 35-mil pencil-style scope probes, by switching to a podlet-style probe tip. The podlets are only 0.1-in. thick and match the de facto, standard 0.1-in. spacing between signal and ground inputs. As a result, they can be connected to the hundreds of readily available IC adapters and clips, making it easy to attach multiple probes to one device.

The podlets hold an active FET circuit that reduces capacitance to less than 2.5 pF. Combined with a 1-MΩ resistance, the low input capacitance significantly reduces the probe's effect on signal quality. Also, a longer ground lead can be used with the probe before signal quality is affected by the lead inductance. The probe tip's low mass of 1.5 g ensures that it won't damage fragile leads or fall off once connected.

To simplify the visual analysis of the acquired signals, the TLS 216's high-resolution color display offers three display formats: a dual-threshold timing diagram, a BusForm display, and the 8-bit analog display. Designers can switch among the three formats without having to reacquire data.

The traditional logic analyzer timing-diagram display was retained because that format makes it easy for engineers to identify unexpected circuit behavior. But the Logic Scope enhances the display by including two thresholds that can be mapped to a specific logic type's low and high switching points—for example, 0.8 and 2 V for TTL. The resulting display shows the signal's switching characteristics, based on the underlying analog data. The amplitude information is eliminated, but the timing resolution and rise and fall times are retained *(Fig. 2)*.



2. AUTOMATED MEASUREMENTS include setup and hold times as well as skew (right). Dual-threshold timing diagrams (upper waveforms) *can be customized* for specific logic types.

With the BusForm format, the designer can display a group of related signals as a single trace. For example, the address inputs to a "by 1" DRAM can be displayed together, or the user can compress multiple signals into one trace, employing it as a reference for other signals. The BusForm can then be reduced in size to allow the maximum screen area for other signals.

Once a timing violation is discovered by using the timing-diagram or BusForm displays, the designer can switch to the analog presentation to troubleshoot the cause of the problem. With the 8-bit vertical resolution and high sampling rate, users can examine in detail signal characteristics such as undershoot, overshoot, and ringing, while toggling between timing and analog formats as desired.

To simplify the debugging process, the Logic Scope performs 28 automated measurements. These include analog parameters that affect timing, such as rise and fall time, overshoot, undershoot, and pulse width. Also included are measurements of multisignal parameters like setup time, hold time, and skew. The instrument even incorporates desktop-publishing capabilities that allow designers to download waveforms to a color printer and transfer waveforms directly to an MS-DOS-compatible floppy disk in the unit's built-in 3.5-in. drive.

All of this functionality could present a complex control problem, so Tektronix worked at creating an easy-to-use interface. The front panel closely resembles that of a traditional oscilloscope, with dedicated knobs to adjust vertical and horizontal parameters. And the TLS 216 has the look and feel of Tektronix's TDS line of oscilloscopes. Menus prompt the user with icons that identify operations. A context-sensitive on-line help system supplies directions for any button or menu entry.☐

PRICE AND AVAILABILITY

The TLS 216 Logic Scope, including the 16 2.5-pF, low-mass FET probes, costs $26,500. Delivery is approximately 8 to 10 weeks after receipt of an order.

Tektronix Inc., Test and Measurement Group, P.O. Box 1520, Pittsfield, MA 01202; (800) 426-2200. **CIRCLE 524**

HOW VALUABLE?	CIRCLE
HIGHLY	581
MODERATELY	582
SLIGHTLY	583

PRODUCTS NEWSLETTER

REDUCED-SIZE PACKAGE SHRINKS MCU FOOTPRINT

Squeezing the MC68302 communications microcontroller into a 144-lead thin quad-sided flat package extends the application range of the circuit into the mobile computing and instrumentation markets. The smaller package, developed by Motorola, Austin, Texas, reduces the footprint area by 38% and trims the thickness by 65% from the original PQFP that housed the 68302. The 20-by-20-by-1.4-mm TQFP lets the microcontroller squeeze into PCMCIA ExCA-compatible function cards, such as modems, fax-modems, and other communications-related cards. The 68302 supports HDLC/SDLC, asynch, bisync, DDCMP, and V.110 protocols over three simultaneously usable serial communication channels. In lots of 10,000 units, the TQFP version sells for $19.99 each; the standard PQFP version costs $17.99 each in similar quantities. Contact Rex Kiang, (512) 891-2429. *DB* **CIRCLE 661**

SINGLE-CHIP TIES IDE DRIVES TO VESA BUS

A single-chip IDE disk controller eliminates all interface logic needed to tie IDE drives to the 32-bit VESA local bus. The 82C611 from OPTi Inc., Santa Clara, Calif., supports data transfers of up to 10 Mbytes/s—about five times the throughput of standard IDE-to-ISA bus interfaces. Part of the performance gain comes from input and output FIFO buffers that permit four-level write posting and read prefetching. The combination allows the CPU memory cycles and IDE operations to run concurrently and exceed AT-bus transfer speeds. The chip comes in a 100-lead PQFP and requires only two inexpensive data buffers. ANSI mode strap options on the chip allow board designers to precisely tune IDE cycle times for ANSI-standard Mode 1 or 2 devices. Other features include full system management interrupt support and IDE command trapping. In lots of 1000, the 82C611 controller costs $6 each. Contact Waqas Khan, (408) 980-8178. *DB* **CIRCLE 662**

KIT HELPS EASE VL-BUS DESIGN CERTIFICATION

The Certification and Compliance Program Pre-Test Kit simplifies compatibility issues for designers of VL-Bus local-bus systems. It offers a compatibility test that can be run on VL-Bus-compliant hardware before submitting the hardware to the VESA-qualified lab for certification. Included are four sections: an overview of basic features; a detailed simulation list to test the bus timing, mechanical requirements, and electrical and environmental specifications; functional testing; and worksheets to record generated data. Contact the San Jose VESA office at (408) 435-0333. *RN* **CIRCLE 663**

PENTIUM CMOS CACHE IMPLEMENTED IN MCM

An extremely high-performance cache memory for leading-edge microprocessors such as Intel's Pentium and i486 DX2 is implemented in multilayer deposited thin-film multichip-module technology. MicroModule Systems, Cupertino, Calif., is using its ChipFrame MCM technology to produce 9-, 10-, and 12-ns CMOS memories organized in a 32 kword-by-72-bit configuration. The memories come packaged in a 160-pin plastic QFP with a 28-mm body size. A customer-configurable cache RAM is also in development and is designed to support organizations of 256 by 18, 64 by 72, and 128 by 36. The caches will help system designers avoid memory-subsystem bottlenecks that can limit total system throughput despite the use of a high-end processor. All will be available using synchronous, burst-mode, and asynchronous technologies. Samples will be available in the fourth quarter with sample pricing starting at $400. Volume shipping is planned for the first quarter of 1994, with bit-for-bit pricing parity with 32-kword-by-9 cache memories expected by the third quarter. Call Howard Green, (408) 864-5986. *DM* **CIRCLE 664**

C++ DEVELOPMENT TOOLS RUN ON RS/6000

The trend to C++ development and the popularity of IBM's RS/6000 workstations are shown in Interactive Development Environment's latest Software Through Pictures C++ Development Environment. With C++DE, developers on RS/6000 workstations and servers can develop with object-oriented notation, select objects from libraries, graphically connect them into new designs, generate compilable code, and produce documentation, all from one multiuser repository. The environment integrates the San Francisco company's graphical design editors and C++ code generator with IBM's C++ Powerbench environment and FrameMaker or Interleaf publishing systems. Single-seat prices for C++DE are $4000 to $13,000. Call (800) 888-IDE1. *SVT* **CIRCLE 665**

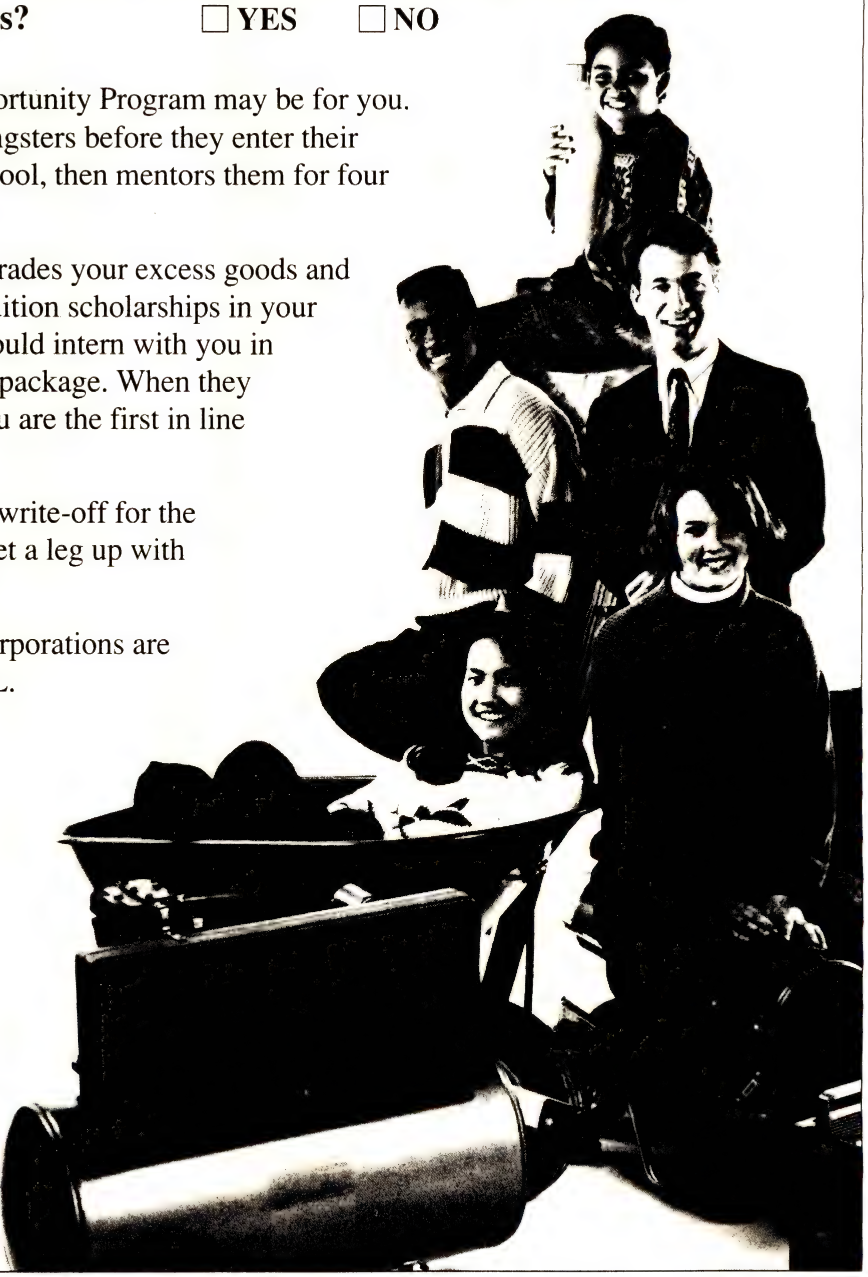
Edited by Clifford Meth

A Short Quiz for America's Executives

1. **Would you like to help disadvantaged young people get an education—and a job?** ☐ **YES** ☐ **NO**

2. **Does your company have excess inventory, services or assets that could be used by colleges?** ☐ **YES** ☐ **NO**

3. **Could your company use an above cost tax deduction for qualified inventory donations?** ☐ **YES** ☐ **NO**



If so, EAL's College Opportunity Program may be for you. EAL targets talented youngsters before they enter their freshman year of high school, then mentors them for four years until they graduate.

How does it work? EAL trades your excess goods and services to a college for tuition scholarships in your name. And the students could intern with you in the summer as part of the package. When they graduate from college, you are the first in line to recruit them.

The result? You get a tax write-off for the donations. And the kids get a leg up with their education. Not bad!

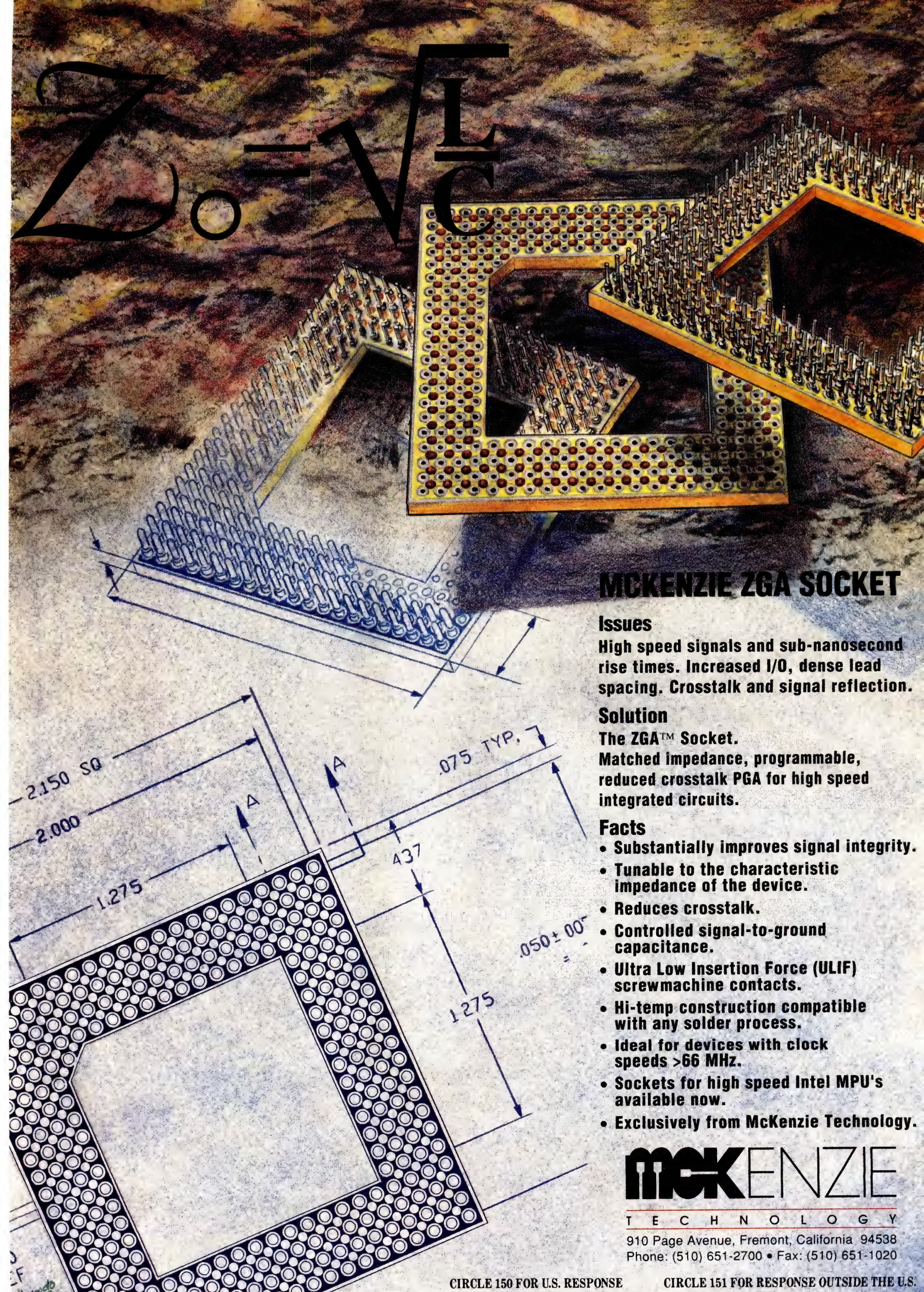
Many of America's top corporations are already committed to EAL.

Why not join them?

EAL

Educational
Assistance Ltd.SM

For more information, contact:
Peter Roskam
Executive Director
(708) 690-0010
P.O. Box 3021
Glen Ellyn, IL 60138



McKENZIE ZGA SOCKET

Issues

High speed signals and sub-nanosecond rise times. Increased I/O, dense lead spacing. Crosstalk and signal reflection.

Solution

The ZGA™ Socket.
Matched impedance, programmable, reduced crosstalk PGA for high speed integrated circuits.

Facts

- Substantially improves signal integrity.
- Tunable to the characteristic impedance of the device.
- Reduces crosstalk.
- Controlled signal-to-ground capacitance.
- Ultra Low Insertion Force (ULIF) screwmachine contacts.
- Hi-temp construction compatible with any solder process.
- Ideal for devices with clock speeds >66 MHz.
- Sockets for high speed Intel MPU's available now.
- Exclusively from McKenzie Technology.

McKENZIE
TECHNOLOGY
910 Page Avenue, Fremont, California 94538
Phone: (510) 651-2700 • Fax: (510) 651-1020

CIRCLE 150 FOR U.S. RESPONSE

CIRCLE 151 FOR RESPONSE OUTSIDE THE U.S.

PENTON CONTINUES COMMITMENT TO RECYCLING

Penton Publishing's Camera Department started recycling chemicals from film wastewater 25 years ago... long before the ecologically-smart idea was widely recognized.

For almost as many years, the Penton Press Division has been recycling scrap paper, obsolete inventory, and printing press waste materials. In 1991, Penton Press will recycle some 5500 tons of paper, 9 tons of aluminum plates, and 3 tons of scrap film negatives. Furthermore, the Press Division has invested $500,000 in air pollution control equipment.

Company-wide, the recycling spirit has spread from Cleveland headquarters to offices throughout the country. Penton employees are enthusiastic participants in expanding programs to re-use paper, aluminum cans, and other waste materials.

Penton Publishing believes these practices make a significant quality-of-life difference for people today... and will help create a safer, healthier environment for generations to come.

Penton Publishing

DOUBLE-CLOCKED CPU UPGRADES 386S TO 486

Replacing a module that was previously offered to a limited number of companies, the Cx486DRx^2 upgrade microprocessor lets users upgrade 386DX-16, 20-, and 25-MHz systems to 486-class performance with a simple chip swap. The upgrade CPU contains a circuit that internally doubles the frequency of the externally supplied system clock, while leaving the bus speed untouched. That allows the chip to drop into 386DX CPU sockets and give many systems a performance kick, extending their useful life. The Cx486DRx^2 includes a 1-kbyte cache, a hardware multiplier, and some I/O improvements (fast I/O) to speed up data transfers and achieve at least a doubling of CPU throughput over the 386 it replaces. To guarantee compatibility, the company also added cache-coherency logic to ensure data integrity between the new CPU's internal cache and the system's memory. A clock duty-cycle correction circuit was also added to ensure that good timing signals are available even if the system's clock doesn't have stable high and low period durations. Single-unit prices are $399, $449, and $499 for the versions that replace the 386-16, -20, and -25, respectively. The upgrade kit includes the CPU, extraction tool, installation manual, and cache installation software. DB

Cyrix Corp., 2703 North Central Expressway, Richardson, TX 75080; Paul Pascarelli, (214) 994-8387. **CIRCLE 721**

CHIP SET PERFORMS REAL-TIME IMAGING

With the ability to run at data rates of 25 MHz, a fixed-point digital-signal processor chip and its accompanying address generator chips process 8-to-24-bit-wide data streams. The high throughput lets the chip set perform real-time digital filtering, image recognition, compress, spectrum analysis, correlation, convolution, and adaptive filtering in either the time or frequency domains. The LH9124L DSP chip uses the same basic architecture as the company's previously released 40-MHz LH9124 and can perform a radix-16 butterfly operation in one pass and a 1-kpoint complex fast-Fourier transform in just 129 µs. The radix-16 butterfly and FFT are but two of the 26 functions built into the 9124L to simplify programming tasks.

The DSP chip and companion address generator (LH9320LU-25) implement a data flow architecture that provides high overall throughput. Integrated on the CMOS chip are six multiplier-accumulators, eight adders, four complex bidirection buses, and 24-bit external and 64-bit internal precision. A typical system would include one LH9124L DSP chip and three LH9320 address generators, both with the ability to drive 20 address bits. The DSP chip comes in a 262-lead PGA package; the 9320L comes in a 68-lead PLCC. An evaluation module and software development tools are also available. The DSP chip sells for $760 each in lots of 100; the address generator sells for $125 each in similar quantities. DB

Sharp Electronics Corp., 5700 N.W. Pacific Rim Blvd., Ste. 20, Camas, WA 98607; Ingrid Story, (206) 834-2500. **CIRCLE 722**

VL-BUS ACCELERATOR SPEEDS GUI OPERATIONS

Delivering graphics throughput close to five times that of standard super VGA controllers, the TGUI9400CXi ties directly to the VESA local bus interface in a PC. The chip also includes the VESA display power-management signalling capabilities, so designers can build systems compatible with the U.S.E.P.A.'s Energy Star power-reduction program. On one chip, the TGUI9400CXi combines a 24-bit true-color d-a converter, a dual clock synthesizer, the SVGA controller core, and a graphical user interface accelerator. The GUI engine on the chip also accelerates color expansion, pattern copy, and screen copy operations by offloading the host CPU and performing the operations in hardware. To get the accelerated performance, the chip includes four levels of read cache and supports up to 2 Mbytes of DRAM video memory. The accelerator subsystem can be implemented with by-4, by-8, and by-16 DRAMs and has programmable DRAM timing to handle most DRAM options. Support for palette swapping and 80/132-column text, as well as resolutions from 640-by-480 pixels with up to 16.8 Mcolors, to 1280 by 1024 pixels with up to 256 colors is also built into the chip. Housed in a 208-lead PQFP, the accelerator chip sells for $17 apiece in 1000-unit lots. DB

Trident Microsystems Inc., 205 Ravendale Drive, Mountain View, CA 94043; Mike Maia, (415) 691-9211. **CIRCLE 723**

FLEXLOGIC FPGA KEEPS I/O DELAYS TO 10 NS

With about 2500 gates of programmable logic or up to 5120 bits of SRAM, the second member of Intel's FLEXlogic FPGA family, the iFX740 keeps I/O delays to just 10 ns. The FPGA can operate at up to 80 MHz yet draws just 1 mA/MHz when active; 500 µA during standby. Smaller than the previously released iFX780, the FPGA includes four configurable function blocks—each serves as a 24V10 PLD or as a block of 128 words by 10 bits of SRAM that can be accessed in 15 ns. The blocks are linked by a wiring matrix that permits 100% connectability.

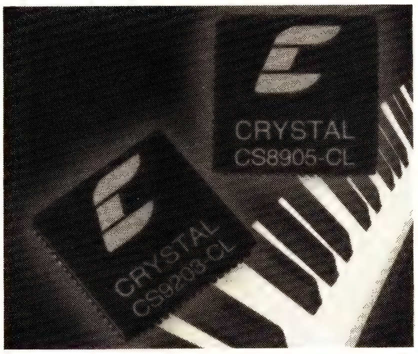
Each configurable block has dual feedback paths on each I/O pin, 12 clocking options, flexible preset and clear options, selectable D or T flip-flop modes, a fast 12-bit identity compare option, and allocation that supports up to 16 product terms per macrocell. The chip comes in a 68-lead PLCC (40 I/O pins, 10 input-only pins, two clock lines and a JTAG test port) or a 44-lead PLCC (30 I/O pins and no input-only pins). In 100-unit lots, the 68-pin iFX740-10 costs $25.60; the 44-lead version is $24.60. DB

Intel Corp., 2200 Mission College Blvd., P.O. Box 58119, Santa Clara, CA 95052-8119; (408) 765-8080. **CIRCLE 724**

MIDI CHIPS BREAK PRICE BARRIER AND OFFER 32-VOICE POLYPHONY

A pair of music synthesis chips from Crystal Semiconductor are among the first to deliver compatibility with the Roland General Synthesizer enhancements to the General MIDI (Musical Instrument Digital Interface) specification. The CS8905 can generate 16 notes simultaneously with a high-quality, 16-bit-stereo, digital-audio output at a 44.1-kHz sampling rate. Designers can opt for up to a 1M-by-12-bit sample set in the wave table that provides sampled sounds for the synthesizer. In combination with the wave table, it can generate up to 188 melodic timbres and 46 special-effect sounds.

The CS9203's faster processor provides a higher range of capabilities. It offers 32-note polyphony, for example, and two 16-bit-stereo digital outputs. The chip can address wave table samples as large as 8M-by-12 bits. It can generate up to 191 melodic timbres and 46 special-effect sounds.



Both chips come in 68-pin PLCCs and are sampling now. Production level quantities will be available in the third quarter of 1993. In 1000-unit purchases, the CS8905 is $24 each and the CS9203 is $36.50 each.

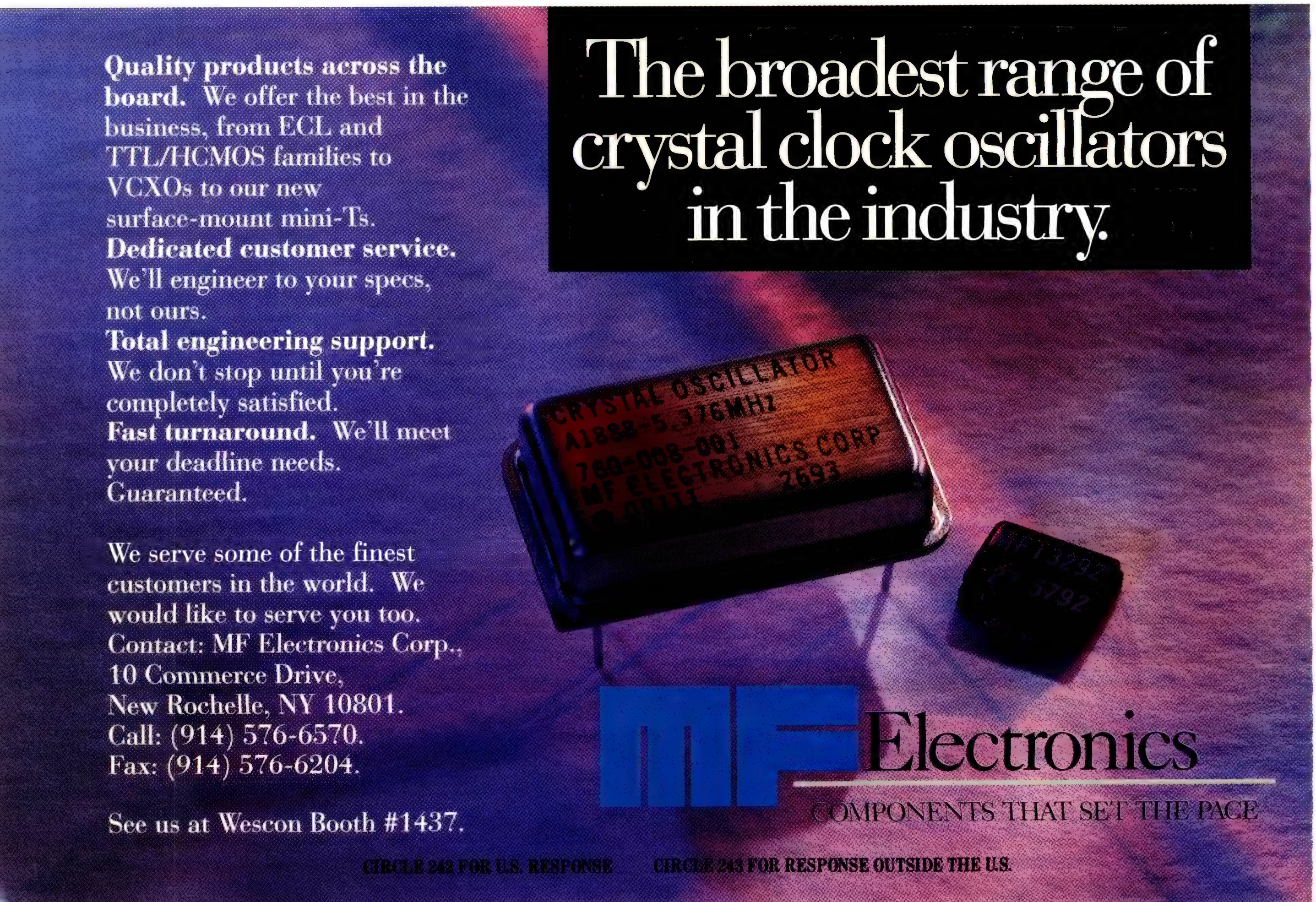
Crystal Semiconductor Corp.,
P.O. Box 17847, 78760, 4210 S. Industrial Dr., Austin, TX 78744; (512) 445-7222. **CIRCLE 795**

■ *JACK SHANDLE*

CHIP PUTS HARD DRIVES INTO PCMCIA SLOTS

The 86017 PCMCIA peripheral-adapter IC accommodates small-form-factor hard-disk drives. The chip supplies the bus-interface and control logic required by the PCMCIA standard. It functions over a 3- to 5.5-V supply range, and lets the hard drives support multiple translation capabilities for compatibility with many bus interfaces. The 86017 IC is available now in a 100-pin low-profile VQFP package. In OEM quantities, it costs $7. RN

ZIA, 2830 N. First St., San Jose, CA 95134; (800) 722-2447.
CIRCLE 726



The broadest range of crystal clock oscillators in the industry.

Quality products across the board. We offer the best in the business, from ECL and TTL/HCMOS families to VCXOs to our new surface-mount mini-Ts.
Dedicated customer service. We'll engineer to your specs, not ours.
Total engineering support. We don't stop until you're completely satisfied.
Fast turnaround. We'll meet your deadline needs. Guaranteed.

We serve some of the finest customers in the world. We would like to serve you too.
Contact: MF Electronics Corp.,
10 Commerce Drive,
New Rochelle, NY 10801.
Call: (914) 576-6570.
Fax: (914) 576-6204.

See us at Wescon Booth #1437.

MF Electronics
COMPONENTS THAT SET THE PACE

CIRCLE 242 FOR U.S. RESPONSE CIRCLE 243 FOR RESPONSE OUTSIDE THE U.S.

Precision Frequency & Time Instruments

Superior performance and reliability at an affordable price. That's the basic philosophy at Stanford Research Systems, a worldwide leader in signal recovery instrumentation for scientific research.

SRS offers a full line of precision electronic test and measurement equipment targeted for both R&D and production applications. SRS products have the features you want, the accuracy you need, the quality you demand, and the low prices which make them truly exceptional values.

STANFORD RESEARCH SYSTEMS MODEL DS345 30MHz SYNTHESIZED FUNCTION GENERATOR
100000000024
MODEL SR760 FFT SPECTRUM ANALYZER
STANFORD RESEARCH SYSTEMS
A=T+ 0.001000000005

Synthesized Function Generators

- 3, 15 or 30 MHz range, all with 1 µHz resolution
- Sine, square, ramp, triangle, and arb waveforms
- Logarithmic / linear sweeps and modulation
- Optional GPIB, RS-232 interfaces

DS335	**$995**
DS340	**$1595**
DS345	**$2195**

FFT Spectrum Analyzers

- 476 µHz to 100 kHz frequency range
- 90 dB dynamic range
- PSD, octave, THD, band, sideband analysis
- Internal source, network analysis (SR770)
- GPIB, RS-232, printer interfaces, 3.5" DOS drive

SR760	**$4750**
SR770	**$6500**

Time Interval / Frequency Counter

- 25 ps single shot resolution
- 1.3 GHz max. frequency, 11 digit resolution
- Statistics, Allan variance, histogram outputs
- GPIB, RS-232 and printer interfaces

SR620	**$4500**

Pulse / Digital Delay Generator

- 4 delay channels, delays to 1000 seconds
- 5 ps delay resolution with 50 ps rms jitter
- GPIB interface, internal or external timebases

DG535	**$3500**

10 MHz Frequency Standard (LORAN-C)

- Cesium clock long term stability (10^{-12})
- Four 10 MHz outputs, adjustable TTL output
- Phase comparator with strip chart output
- GPIB interface, 8' antenna, 100' coax cable

FS700	**$4950**

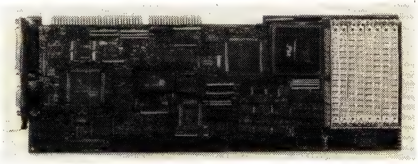
SRS

STANFORD RESEARCH SYSTEMS

1290 D Reamwood Ave., Sunnyvale, CA 94089, TEL: (408) 744-9040, FAX: 4087449049

CIRCLE 214 FOR U.S. RESPONSE CIRCLE 215 FOR RESPONSE OUTSIDE THE U.S.

486 COMPUTER BOARD FITS AT FORM FACTOR

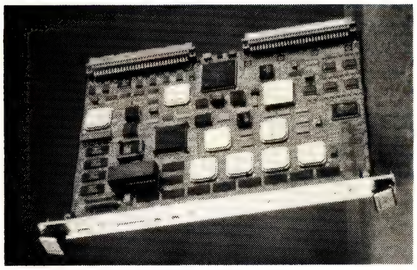


A full-function platform can be built using the MNC 1144C, a single-board computer that's based on a socketed PGA 486 microprocessor running from 25 to 66 MHz. Any PGA 486 can be installed because the CPU clock speed is jumper selectable. The AT form factor board includes a video controller for simultaneous SVGA CRT and flat-panel displays (LCD and plasma), a power-fail monitor, floppy-and hard-disk interfaces, serial and parallel ports, and up to 1 Mbyte of flash memory. The DRAM memory-management device adds support for page mode and two-or four-way interleaving with up to 32 Mbytes. Power requirements are 3.7 A at 5 V dc and 100 mA at ±12 V dc. Evaluation units are available now for $695, with no processor or memory. Large-quantity discounts are available. RN

MNC International Inc., 2817 Anthony Lane South, Minneapolis, MN 55418; (612) 788-1099.

CIRCLE 727

6U VME SBC HARNESSES 50-MHz RISC CPU



The 50-MHz 88110 symmetric superscaler RISC microprocessor forms the brains behind the MVME197 6U VME single-board computer. The board is suited for real-time, compute-intensive applications, such as telecommunications, simulation, and diagnostic testing. Offered in 32- and 64-Mbyte configurations, the 197 includes SCSI-2 and Ethernet support. There's also a mezzanine connector to add up to 512 Mbytes of system memory. An on-board switch converts peripherals connected to the board's 32-bit local bus to the 88110's 64-bit system bus. The memory architecture supports burst data transfers and supplies error checking and correction.

The 197 board is the first in a series that will include multiprocessor boards with larger external caches and more on-board memory. The 32-Mbyte board sells for $9995, while the 64-Mbyte version is priced at $13,995. RN

Motorola Inc., 2900 South Diablo Way, Tempe, AZ 85282. **CIRCLE 728**

If you need more than just a battery!

Sonnenschein Lithium Thionyl Chloride Batteries

The most effective solution for the widest range of professional battery needs in the electronics field. Safety and reliability in memory backup applications as well as in use as a primary power source.
Under the roughest operational conditions for a long life time.

Performance:
- high cell voltage: 3.6 V
- high energy density: up to 630 Wh/Kg and 1,240 Wh/dm^3
- wide temperature range: −55 °C to +85 °C (special versions up to 150 °C)
- long storage life: self discharge rate < 1 % of nominal capacity p.a. at RT

Safety and Reliability:
- hermetic sealing
- no internal pressure
- safe from short circuit

Versatility
- 9 different cell sizes
- cell capacities from 0.37 to 30 Ah
- battery packs in different shapes, various mechanical configurations, connectors and safety devices.

Talk to our specialists now.

Sonnenschein Lithium

Sonnenschein Lithium GmbH
Industriestrasse 22, D-63652 Buedingen
West Germany
Telephone (0 60 42) 815 22 · Telex: 4102180
Telefax (0 60 42) 815 23

CIRCLE 208 FOR U.S. RESPONSE
CIRCLE 209 FOR RESPONSE OUTSIDE THE U.S.

"If you doubt the power of advertising I suggest you consult a doctor."

"Colon cancer is a disease that afflicts more than 150,000 Americans each year and eventually kills over half. Yet, any doctor will tell you that with early detection, the survival rate could be raised to as much as 90%.

Can advertising have the power to make people confront this disease, overcome their fear and actually consult their doctors about it?

You bet your life it can.

Take the case of the Advertising Council's campaign against colon cancer. The first-ever study of public service advertising that actually isolated the impact of advertising from other market elements like the news, editorials and public relations.

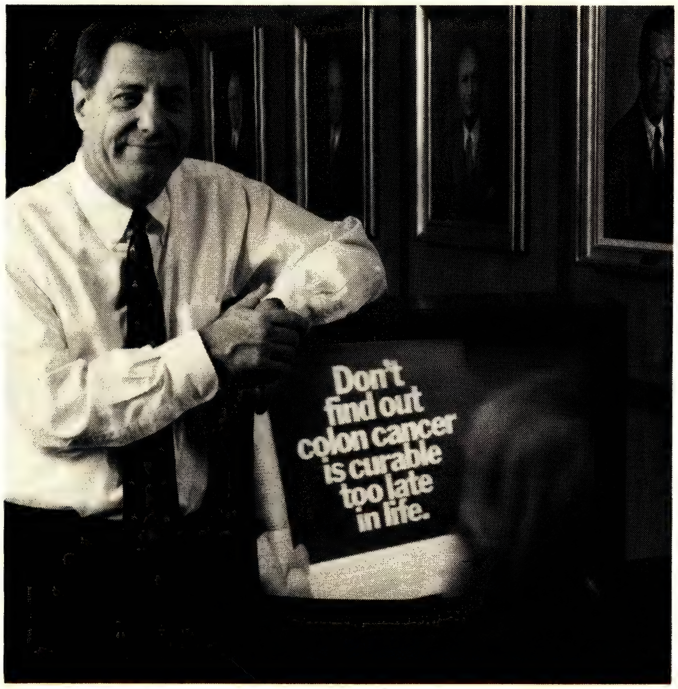
Research was conducted from July 1989 to July 1990 in 4 markets in 10,000 households, at the equivalent of $21.3 million worth of air time, the average amount of donated time behind Advertising Council spots.

After six months of being exposed to one commercial, awareness of colon cancer among adults 40 and over rose from 11% to 29%.

After a year, awareness reached 40%.

The number of men who consulted their doctors more than doubled to 15%.

Now, if advertising can get people to see their doctors about something as unpalatable as colon cancer, don't you think it can get people to consider your product?



Herb Baum, Pres., Campbell North & South America and Chm. of the Advertising Council.

Oh, there's one more thing. If you're over 40, ask your doctor about colon cancer."

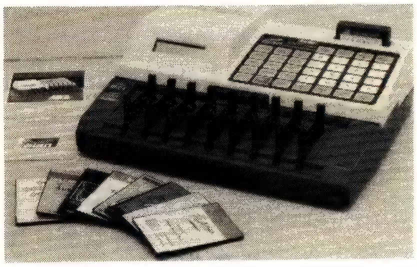
AAAA
American Association of Advertising Agencies

If you would like to learn more about the power of advertising, please write to Department D, AAAA, 666 Third Avenue, New York, New York 10017, enclosing a check for five dollars. You will receive our booklet *It Works! How Investment Spending In Advertising Pays Off.* Please allow 4 to 6 weeks for delivery.

This advertisement was prepared by Calet, Hirsch & Ferrell, Inc., New York, New York: Photo: Fred Weber.

COPY MULTIPLE PCMCIA CARDS

The 5-J08 card copier can copy the data on PCMCIA memory cards. The types of cards supported include those from most popular manufacturers, including Epson, Fujitsu, Intel, ITT Canon, Mitsubishi, Texas Instruments, and Toshiba. In addition, the system can be updated to support new card introductions and algorithms as they become available. All cards are programmed using approved device-programming algorithms. Sophisticated monitoring during the programming process insures card protection and data security. The 5-J08 comes with 512 kbytes of RAM, upgradable to 16 Mbytes. A keypad gives access to the programming functions, such as verify and card erase. A built-in serial port allows files to be downloaded from a PC. The 5-J08 copier costs $5695. RN



Elan Systems Inc., 365 Woodview Ave. No. 700, Morgan Hill, CA 95037; (800) 541-3526. **CIRCLE 729**

SBUS SYSTEM RUNS UNIX OR REAL-TIME OS

The PT-sys5k SBus system addresses the needs of integrators of Sparc-based real-time and embedded systems by combining increased expansion capabilities and rugged designs with Unix compatibility and Posix compliance. The 29-MIPS system, built with a 40-MHz Sparc CPU, comes from a joint development between Performance Technologies Inc. and Lynx Real-Time Systems. It's built in a sturdy rack-mounted aluminum case with two filtered, temperature-controlled cooling fans and offers eight SBus slots, making the system highly customizable. The system features 2 to 64 Mbytes of system memory, two asynchronous serial ports, an Ethernet port, and a SCSI-2 interface. It can also operate in a diskless fashion by embedding the operating system and application code in ROM. The system runs the Lynx real-time operating system or Solaris 1.1. The PT-sys5k is available now for $5995. It's also available in a four-slot configuration and in tabletop and tower models. RN

Lynx Real-Time Systems, 16780 Lark Ave., Los Gatos, CA 94538; (408) 354-7770. **CIRCLE 730**

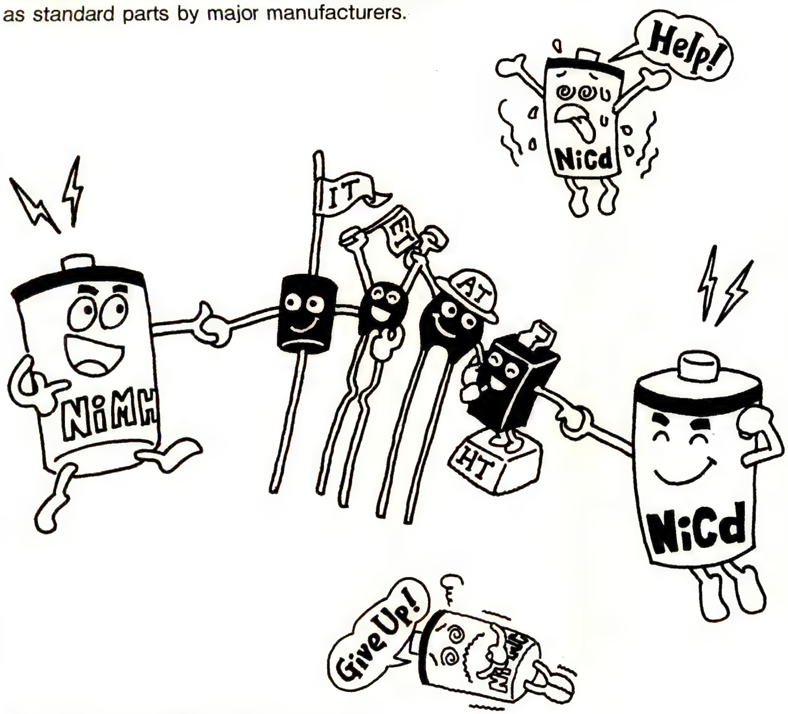
Performance Technologies Inc., 315 Science Pkwy., Rochester, NY 14620; (716) 256-0200. **CIRCLE 731**

SEMITEC Thermistors assure full and secure recharging for rechargeable battery packs.

During an accelerate charge in a rechargeable battery pack (Nicd, NiMH), thermistors are used to control the temperature.

Thermistors are very essential to controlling the temperature against high heat for charging the battery to its potential.

SEMITEC has a wide selection of thermistors which come highly recommended as standard parts by major manufacturers.



for more information please contact…

SEMITEC®
Ishizuka Electronics Corporation
HEAD OFFICE
7-7, Kinshi 1-chome, Sumida-ku, Tokyo 130, Japan
Tel: (3)3621-2704 Fax: (3)3623-7776
●TAIWAN : TAIPEI OFFICE TEL : 02-509-9855 FAX : 02-509-9599
●U.S.A : SEMITEC USA TEL : 516-587-4086 FAX : 516-321-9604
●KOREA : JINSUNG CORP. TEL : 02-851-3127 FAX : 02-851-3129

CIRCLE 134 FOR U.S. RESPONSE
CIRCLE 135 FOR RESPONSE OUTSIDE THE U.S.

You get superior quality in KEMET capacitors, because we put superior training in KEMET people.

Automated production makes our components good—and top-notch people make them great. Here's how our company-wide training programs pay off for you in important cost-savings.

Better quality—at a reasonable cost—comes automatically. Our better-trained people efficiently eliminate production problems, to assure that our products meet your specifications exactly.

Product consistency is vital—that's why most of our people are cross-trained on several jobs, to assure that qualified people are always available.

We keep costs down through continual product and production improvements. It takes inspired people to achieve that, so we continually train and motivate ours.

The quality of our people is one of many reasons we think you should consider a partnership with KEMET.

A long-lasting, productive partnership.

KEMET®
Electronics Corporation

P.O. Box 5928
Greenville, SC 29606
803/963-6348

U.S.A., Newport Beach, CA, Phone: (714) 640-9320, FAX: (714) 720-9807; **Irving, TX,** Phone: (214) 241-7501, FAX: (214) 241-5604; **Schaumburg, IL,** Phone: (708) 517-1030, FAX: (708) 517-1037; **Wakefield, MA,** Phone: (617) 245-4646, FAX: (617) 245-1595; **Greenville, SC,** Phone: (803) 242-5789, FAX: (803) 242-5795; **EUROPE, Switzerland,** Phone: 41-22-715-0111, FAX: 41-22-738-3918; **Germany,** Phone: 49-89-46-30-01, FAX: 49-89-46-04-117; **France,** Phone: 33-1-46-87-70-95, FAX: 33-1-49-78-06-63; **United Kingdom,** Phone: 44-279-757-343, FAX: 44-279-757-188; **ASIA, Hong Kong,** Phone: 852-363-1088, FAX: 852-363-2161; **Singapore,** Phone: 65-227-2225, FAX: 65-227-2224; **Taiwan ROC,** Phone: 886-2-752-8585, FAX: 886-2-721-3129; **Korea,** Phone: 82-2-712-5821, FAX: 82-2-712-5823

CIRCLE 136 FOR U.S. RESPONSE

CIRCLE 137 FOR RESPONSE OUTSIDE THE U.S.

FRAME GRABBER OFFERS AUDIO, TUNER CONTROL

A real-time image-capture and windowing video board for ISA- and EISA-bus PCs accepts NTSC and PAL video from multiple sources, including VCRs, video cameras, and laser discs. In addition to frame grabbing, the Media Windows board from Colorgraphic Communications offers scaling, zoom, and software controls for video, tuner, and audio. Integrating Brooktree Inc.'s Bt812 video decoder and Chips & Technologies Inc.'s Pro Video Scaler, the board supports 1024-by-768-pixel resolution, 16.7 million colors, and Microsoft Windows. Tuner software controls channel, noise inversion, and fine tuning. With it, Windows users can access 122 cable TV channels. Video controls include input source, brightness, contrast, hue, freeze, zoom, and video standard. Audio software controls include source, volume left and right, format, bass, treble, and mute. Available now, the board costs $995. JS

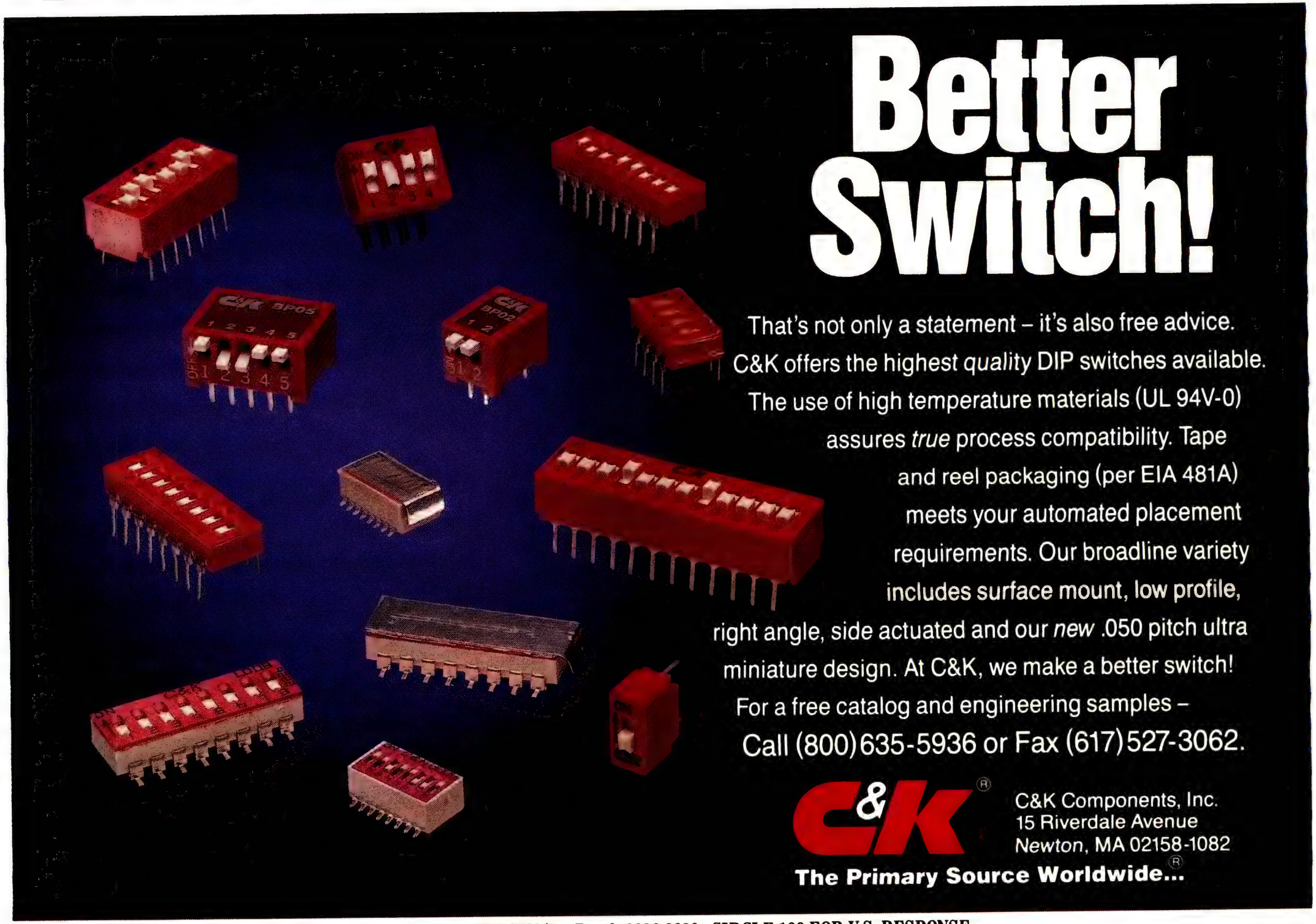
Colorgraphics Communications Inc., 5388 New Peachtree Rd., P. O. Box 80448, Atlanta, GA 30366-0448; (404) 455-3921.
CIRCLE 732

GRAPHIC WORKSTATIONS SUIT 3D APPLICATIONS

A family of three graphics workstations, the Sparcstation 10TurboGXplus, the Sparcstation ZX, and the Sparcstation 10ZX, are suited for 3D graphics applications, such as electronic design automation, mechanical CAD, and geographical information systems. The 10TurboGXplus delivers more than 1 million 2D vectors/s using one SBus accelerator. It also features double buffering for smooth animation of 2D and 3D wireless images and screen resolutions up to 1600 by 1280 pixels.

The ZX can compute up to 290,000 triangle meshes/s. The 10ZX offers similar graphics performance, but has higher computational performance, multiprocessing capabilities, more disk and RAM capacity, and greater flexibility. The graphics acceleration in the two systems comes from one double-sized SBus card. The ZX sells for $19,995, while the 10ZX starts at $28,745. RN

Sun Microsystems Inc., 2550 Garcia Ave., Mountain View, CA 94943; (415) 960-1300. **CIRCLE 733**



Better Switch!

That's not only a statement – it's also free advice. C&K offers the highest quality DIP switches available. The use of high temperature materials (UL 94V-0) assures *true* process compatibility. Tape and reel packaging (per EIA 481A) meets your automated placement requirements. Our broadline variety includes surface mount, low profile, right angle, side actuated and our *new* .050 pitch ultra miniature design. At C&K, we make a better switch!

For a free catalog and engineering samples –
Call (800)635-5936 or Fax (617)527-3062.

C&K®
The Primary Source Worldwide...®

C&K Components, Inc.
15 Riverdale Avenue
Newton, MA 02158-1082

See us at WESCON/93, Booth 6626-6630 CIRCLE 100 FOR U.S. RESPONSE
CIRCLE 101 FOR RESPONSE OUTSIDE THE U.S.

Aren't you a little old to be putting batteries in your toys?

Nonvolatile random access memory is a grown-up problem. But now you can design in nonvolatility without batteries and without sacrificing performance, reliability, density or anything else you need. With the revolutionary nvSRAM from Simtek.

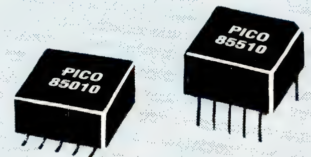
It's truly a one-chip solution. At 64K, Simtek's nvSRAM has four to sixteen times the capacity of competing products. With access speeds from 25-55ns, it's fast, too. Of course, since there's no battery to fail, you can forget about reliability worries.

Skeptical? Let us show you what we can do. Call today for your nvSRAM Design Kit, only $24.95 which we'll credit towards your first order. You'll have it in 48 hours. See for yourself just how well your toys can run without batteries.

SIMTEK

800-637-1667 719-531-9444 Fax 719-531-9481
Simtek Corporation 1465 Kelly Johnson Blvd. Colorado Springs, CO 80920

CIRCLE 334 FOR U.S. RESPONSE CIRCLE 335 FOR RESPONSE OUTSIDE THE U.S.



PICO

Multiplex Data BUS Pulse Transformers

MIL-STD-1553

Actual Size
.4″ × .4″ × .2″Ht.

- Surface Mount
- Plug-In
- QPL Standards
- MIL-T-21038/27C
- MIL-STD-1553

These pulse transformers manufactured to MIL-STD-1553 COMMAND/RESPONSE MULTI-PLEX DATA BUS requirements. They also are manufactured to MIL-T-21038/27C specifications and are designed to meet MAC AIR SPECIFICATIONS A3818, A5690, A5232 and A4905.

All of these transformers exhibit superior electrical performance. Common mode rejection ratio is greater than 45dB at 1 MHz. Input impedance is greater than 3000 ohms over the band from 75 kHz to 1MHz at 1V rms. This series possesses exceptional waveform integrity: Rise time and fall time is less than 100 nanoseconds. Overshoot and ringing is less than ± 1V peak. Droop is less than 20%.

Delivery—stock to one week

See EEM
or send direct
for **Free** PICO Catalog.
Call toll free **800-431-1064**
in NY call **914-699-5514**
FAX **914-699-5565**

PICO Electronics, Inc.
453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552

CIRCLE 308 FOR U.S. RESPONSE
CIRCLE 309 FOR RESPONSE OUTSIDE THE U.S.

IR DATCOM COMPONENTS TARGET SMALL SYSTEMS

A family of low-power, infrared, data communication devices feature small packages and high data rates. Products in the RY5 Series from Sharp Electronics Corp. all include a discrete receiver, transmitter, and bidirectional data unit capable of data rates up to 19.2 Kbits/s. Created using the technology developed for Sharp's Wizard model OZ-9600, the devices can also be used for wireless keyboards, mice, pen-based systems, wireless data transfers between personal communicators an PCs, and other applications. They are TTL/CMOS compatible, operate over a 900- to 1050-nm wavelength and use 500 kHz amplitude-shift-keying modulation for transmission. The devices are all being sampled now. The RY5BD01 bidirectional transceiver is priced at $15 in 100-unit purchases; the RY5AR01 receiver, $13; and, the RY5AT01 transmitter, $10.30. JS

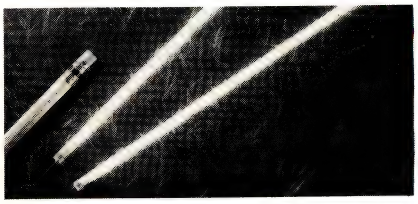
Sharp Electronics Corp., 5700 NW Pacific Rim Blvd., M/S 20, Camas, WA 98609; (800) 642-0261. **CIRCLE 734**

TANTALUM-CHIP CAPS SATE SMALL SUPPLIES

A line of highly efficient tantalum-chip capacitors offers a low equivalent series resistance for use in small power supplies. The TPS Series capacitors offer a wide range of values from 4.7 to 330 µF. They come in standard EIA D and E case sizes and are molded to facilitate pick-and-place assembly. Capabilities include high ripple current, low ripple voltage, and low power dissipation. The devices are stressed under conditions simulating power-supply applications using minimal series resistance in the circuit. Call for pricing and delivery. DM

AVX Corp., 801 17th Ave. S., Myrtle Beach, SC 29577; Dave Mattingly, (803) 946-0690. **CIRCLE 735**

TINY FLUORESCENT LAMP MEASURES 4.8 MM AROUND



What may be the smallest practical-sized fluorescent lamp available has been introduced in the BF4118 Series lamp. The lamp measures just 4.8 mm in diameter and comes in lengths of 118, 142, and 272 mm. The cool-operating, energy-efficient lamp has applications in backlighting active-matrix LCDs as well as others in medical instrumentation and security systems. Pricing begins at $8 in sample quantities. DM

JKL Components Corp., 13343 Paxton St., Pacoima, CA 91331-2376; Joe Velas, (818) 896-0019. **CIRCLE 736**

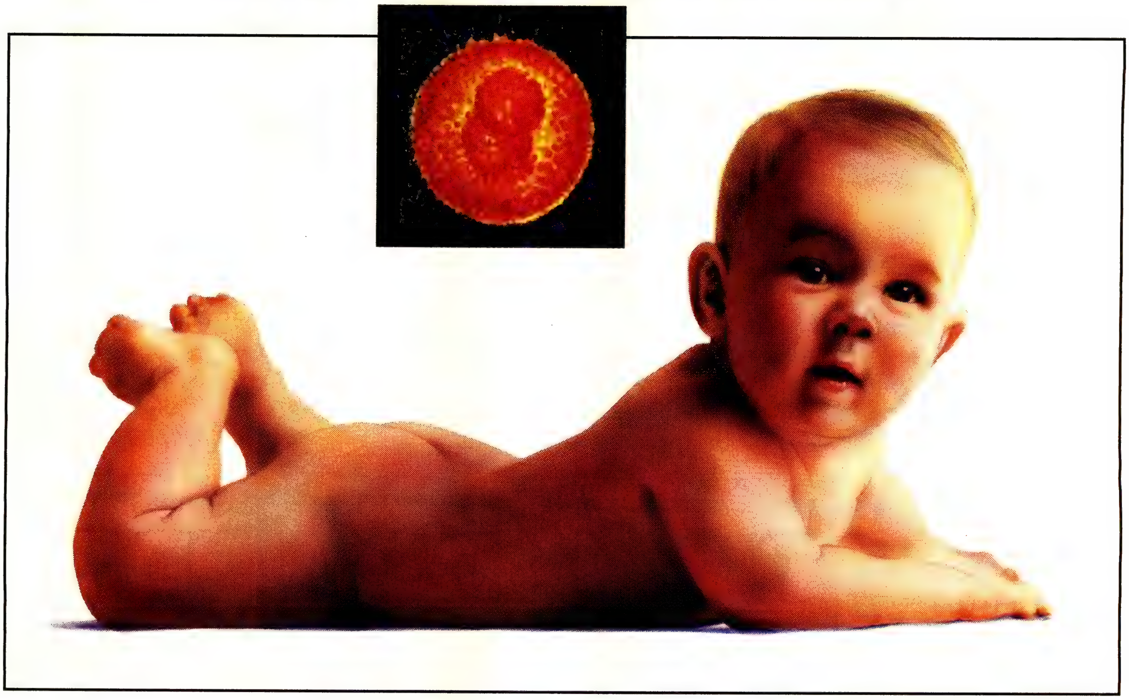
LOW-VOLTAGE VARISTORS SUIT REGULATION TASKS

A series of low-voltage, bi-directional silicon varistors is designed for controlled dc voltages of 0.5 to 5 V at various current levels. The MSV101A through MSV101G and MSV201A through MSV701A devices are rated for various peak pulse-transient currents up to 50 A for effective clamping voltages of 1.5 to 9.4 V at 25°C. Continuous power rating is 1 W. The devices, which are packaged in axial-lead packages with 30-mil leads, are well suited for low-voltage regulators. Pricing and availability depend on part numbers. For example, the MSV401A goes for $0.79 in lots of 1000 with delivery in eight to 10 weeks. DM

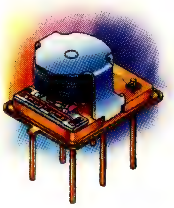
Microsemi Corp., P.O. Box 1390, Scottsdale, AZ 85252; Kent Walters, (602) 941-6524. **CIRCLE 737**

THE NEW ULTRAMINIATURE A150 ATTENUATOR RELAY

The Critical Cell Of The RF Attenuator Has Become The Whole Attenuator



THE FIRST SELF-CONTAINED, ULTRAMINIATURE SWITCHABLE ATTENUATOR!

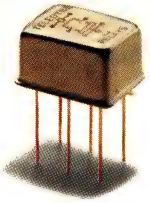


Teledyne Relays' new A150 Attenuator Relay* is specifically engineered to provide a hermetically sealed electro-mechanical relay that can attenuate RF signals without additional external components.

Our new self-contained switchable attenuator provides high isolation between control and signal paths, stable attenuation vs. temperature, excellent phase linearity vs. frequency and outstanding intermodulation performance. The A150 Attenuator Relay is designed for use in 50 ohm systems over the frequency range from dc to 3 GHz. The unit is less than .050 cubic inches in volume, occupies less than 0.200 square inches of board space and weighs less than 0.12 ounces. The thin-film matched attenuator pad is integrated into the unit's mechanical switching circuit.

The A150 Attenuator Relay is housed in Teledyne Relays' extended Centigrid® hermetically sealed package. The two rows of connecting leads are 0.200″ apart and the leads are spaced 0.150″ center-to-center. It also features internal welded construction and uni-frame design for high motor magnetic efficiency and exceptional mechanical ruggedness. Its gold-plated precious metal contacts assure low contact circuit losses and reliable switching.

The A150 is the only RF Attenuator of its kind. For price, delivery and technical information, call **1-800-284-7007** or FAX us at 1-213-779-9161.



Actual size

TELEDYNE RELAYS
Innovations In Switching Technology

*Patent pending

Home Office, 12525 Daphne Avenue, Hawthorne, CA 90250 • Telephone: **213-777-0077** • FAX: **213-779-9161**
OVERSEAS: GERMANY, **(0611) 7636-143;** ENGLAND: **(081) 571-9596;** BELGIUM: **(02) 673-99-88;** JAPAN: **(03) 3797-6956.**

CIRCLE 220 FOR U.S. RESPONSE

CIRCLE 221 FOR RESPONSE OUTSIDE THE U.S.

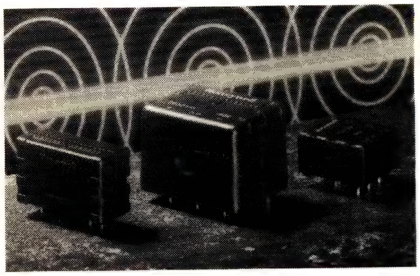
PC-BOARD SPEAKER IS WAVE-SOLDERABLE

A wave-solderable, voice-quality miniature speaker for through-hole pc boards permits replacement of piezo buzzers with spoken-word or musical communication in a wide range of applications. The Model 8032VT speaker is 23 mm in diameter with an 8.4-mm profile. It also withstands cleaning with chlorinated solvents. Frequency response is from 350 to 3500 Hz with an output of 81 dB (at 10 cm with a 1-kHz, 0.89-V input). Maximum signal input is 0.15 W and maximum current throughput is 142 mA. Call for pricing and delivery information. DM

ISL Products International Ltd., 235 Robins Lane, Suite 270, Syosset, NY 11791; (800) 626-6116.

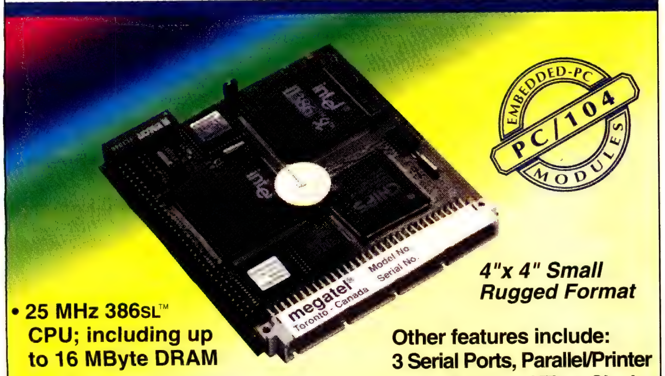
CIRCLE 738

CURRENT SENSORS READ FROM NULL BALANCE



Measurement of ac, dc, and impulse currents over ranges of zero to 25, zero to 50, and zero to 100 A is performed by the CSN Series null-balance current sensors. The units are based on the principles of the Hall effect and the null-balance, or zero-magnetic-flux, method. The magnetic field on the sensor is constantly held at zero. The current required to balance zero flux is the measure of the primary current flowing through the conductor multiplied by the ratio of the primary to secondary windings. The 50-A and 100-A sensors are through-hole devices designed to measure high currents with primary-to-secondary ratios of 1:1000 to 1:2000. The 25-A product uses the invasive principle and is automatically inserted into pc boards without need for a separate primary conductor. Typical uses include variable-speed drives, overcurrent protection, power supplies, and feedback-control systems. Pricing is $15 in lots from 5000 to 10,000. Call for delivery information. DM

Micro Switch, a Honeywell Division, 11 W. Spring St., Freeport, IL 61032; (800) 537-6945. **CIRCLE 739**


Embedded PC with on-board Ethernet and Super VGA

4"x 4" Small Rugged Format

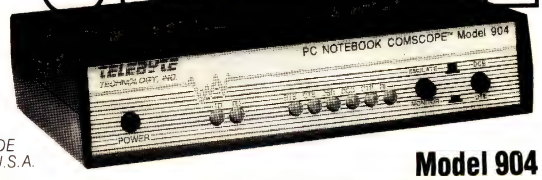
- 25 MHz 386SL™ CPU; including up to 16 MByte DRAM
- On-board Super VGA LCD/Video controller
- On-board Ethernet, Featuring AUI and 10 BASE•T interfaces
- On-board SCSI, Floppy, controllers and 2 MByte Flash Eprom Solid State Disk
- +5 volt only operation, 5 watts power consumption

Other features include:
3 Serial Ports, Parallel/Printer port, BIOS, Real Time Clock, I/O Bus Expansion
For more information call:
Megatel Computer Corporation
125 Wendell Ave., Weston, Ont.
M9N 3K9 Fax: (416) 245-6505
(416) 245-3324

Megatel is a registered trademark of the Megatel Computer Corp. 386SL is a trademark of Intel Corporation

megatel®

CIRCLE 314 FOR U.S. RESPONSE
CIRCLE 315 FOR RESPONSE OUTSIDE THE U.S.


POWERFUL

MADE IN U.S.A.

Model 904
PC NOTEBOOK COMSCOPE™ PROTOCOL ANALYZER

Powerful and flexible protocol analyzer. Ideal for desktop or notebook PC. **Designed to avoid the need for a PC expansion slot.** With the Protocol Emulator Program Interface (PEPI), the Model 904 has unlimited versatility. It can monitor data lines on a full duplex basis to 128KBPS and emulate up to 64KBPS.

- Small Portable Unit
- Serial Port Operation with all PC's
- Monitors & Emulates X.25, HDLC, Async, Bisync
- Built-in BERT Tester
- Split Screen Decode of X.25 & SDLC
- Menu Driven
- Time Stamping
- Programmable

$995

TELEBYTE TECHNOLOGY, INC.

270 E. Pulaski Road
Greenlawn, NY 11740
TEL: (516) 423-3232
FAX: (516) 385-8184
1-(800) 835-3298

CONNECT • COMMUNICATE • SUPPORT

CIRCLE 218 FOR U.S. RESPONSE
CIRCLE 219 FOR RESPONSE OUTSIDE THE U.S.

Billions will be spent on new wireless technologies.

Wireless technologies are transforming commercial communications into an explosive, multi-billion dollar industry. The market is growing and changing, with everyone competing for a share. It's essential to get your products to market ahead of the competition—and at lower production cost. That's where EEsof can help.

As the leader in high-frequency EDA, we can help you get more than your share.

EEsof's Series IV™ design tools are the only high-frequency analog software products you need to succeed.

For the past ten years, EEsof has focused exclusively on developing high-frequency simulation software to increase design and manufacturing efficiency. As a result, EEsof is helping customers design competitive products at over 2,000 sites around the world.

Series IV's true design for manufacturing capabilities take your design from concept through production.

What's more, EEsof has the most powerful set of tools available for bringing accurate circuit, system, and board-level designs to market quickly and at minimal production expense.

In fact, nobody has more expertise in developing advanced simulator technologies, creating accurate models, building libraries of over 50,000 devices, and designing-in manufacturability. Which explains why EEsof's Series IV is the first and only software suite to offer completely integrated high-frequency EDA tools for creating high-yield, low-cost designs.

Reduce your costs significantly by replacing test hardware with a virtual software laboratory.

The wireless communications market will grow well into the next decade. Now is the time to capitalize on your opportunities with EEsof's Series IV. It's the competitive advantage you need for success. Call EEsof at 818-879-6451. In the U.S., call 800-343-3763.

EEsof®

EEsof Incorporated, 5601 Lindero Canyon Road, Westlake Village, California 91362
© 1993 EEsof Incorporated. 015

CIRCLE 118 FOR U.S. RESPONSE CIRCLE 119 FOR RESPONSE OUTSIDE THE U.S.

VXI-BASED PACKAGE DOES BOUNDARY-SCAN TESTS

The Integra series of hardware and software products supply a complete, VXI-based solution for debugging and testing systems incorporating boundary scan. The products result from an alliance between Tektronix, Teradyne, and Texas Instruments.

The initial offering includes the VX4491 Serial Test Module, a powerful scan module; several Asset VXI test development and diagnostic software options, which are Tektronix-exclusive extensions of Texas Instruments' Asset software; and the Virtual Interconnect Test package, a subset of Teradyne's Victory software. Combined, these tools allow design and test engineers to generate tests manually or automatically, translate vectors developed in the simulation environment, and interactively control and observe the unit under test (UUT) through the boundary-scan test points.

The VX4491 uses a compression algorithm to permit serial scan depths of over 100 Mvectors, including mask and comparison patterns. Test results are compared on-board rather than in the system controller, for minimum communications overhead.

A Tek-developed Fast Data Channel protocol cuts VXIbus transfer time during pattern upload and download. The module comes with the Serial Toolbox software, which offers translation of vector files, download and execution of tests, and logging and viewing of results.

All Integra series software runs under DOS/Windows 3.1, on embedded or external PC controllers. The Asset VXI Test Vector Development System allows flexible development of test vectors and manages application of the vector set to the UUT. The Asset VXI Diagnostic System delivers real-time interaction between the user and the UUT. The Asset Virtual Interconnect Test package automatically creates interconnect tests with 100% fault coverage in full-scan designs.

The VX4491 costs $5500 with 1 Mbyte of pattern memory. The 16-Mbyte option costs $2000. The Asset VXI Test Vector Development System costs $5995, the Asset VXI Diagnostic System software $11,495, and the Asset Virtual Interconnect Test software $14,995. The scan function library is $2495, and the developer's kit is $8995. Delivery is within eight weeks.

***Tektronix Inc.** Test and Measurement Group, P.O. Box 1520, Pittsfield, MA 01202; (800) 426-2200.* **CIRCLE 740**

■ *JOHN NOVELLINO*

Looking For A Quality BoardHouse?
All Your Circuit Board Needs Under One Roof

PCB Manufacturing
- 2 day turn around on multi-layers
- Prototype and production
- PCMCIA up to 6 layers
- Gerber Data Test
- Turnkey assembly

PCB Layout
- Backplanes
- Impedance Control
- Analog and ECL
- SMT both sides

Technical Assistance
- PCB layouts on multi-layers
- Mfg cost cutting tips
- Gerber Data via modem, 24 hours (714)970-5015

CALL FOR A QUOTE!

MC Murrietta Circuits

VISA (714) 970-2430 FAX (714) 970-2406 MC

4761 E. Hunter Ave., Anaheim, CA 92807

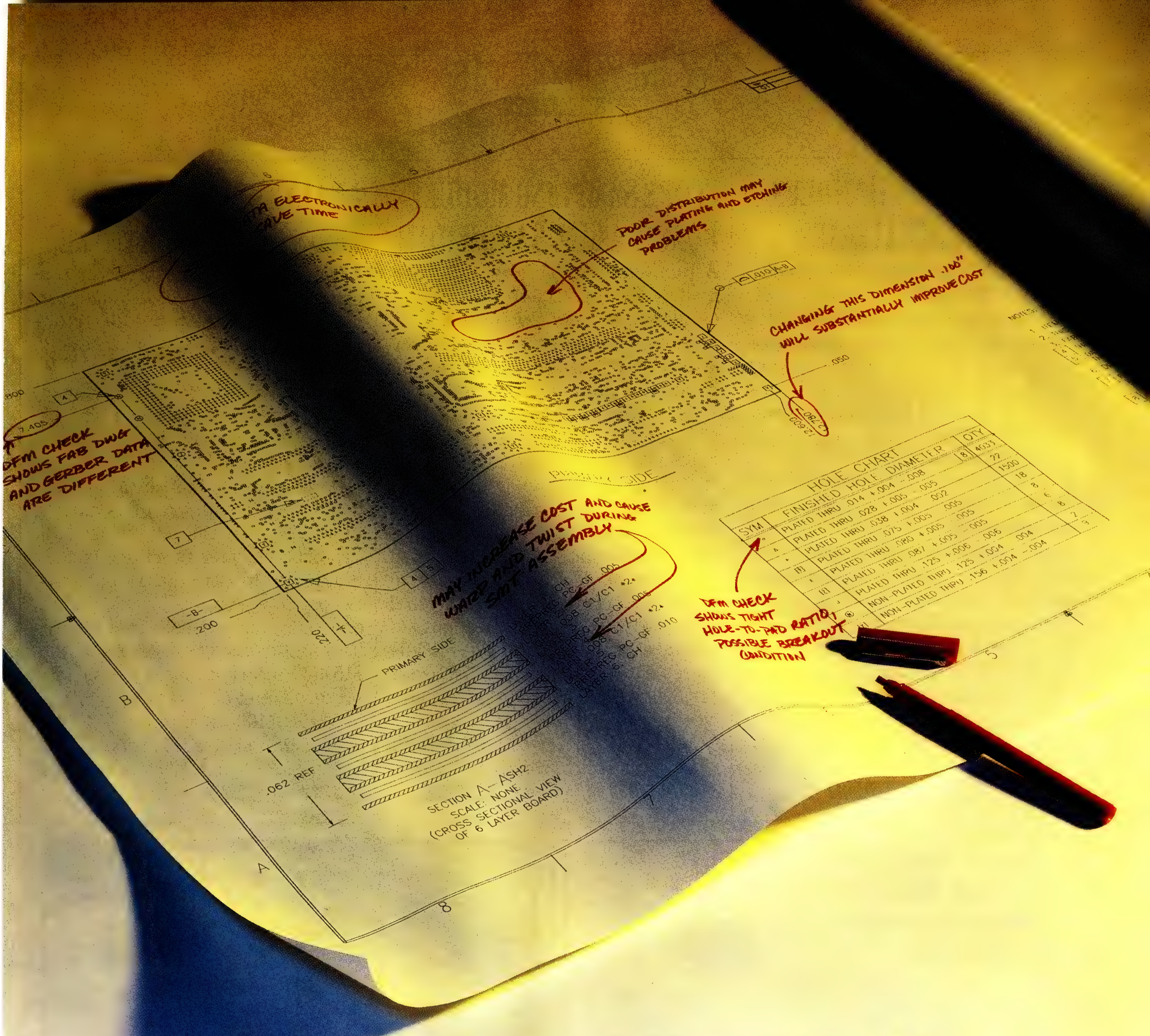
CIRCLE 164 FOR U.S. RESPONSE
CIRCLE 165 FOR RESPONSE OUTSIDE THE U.S.

"YOUR FREE CATALOG KNOCKED MY SOCKS OFF"

Our free Catalog of free and low-cost government booklets will very likely knock your socks off, too. But first you have to get it. Just send your name and address to:

Consumer Information Center
Department KO
Pueblo, Colorado 81009

A public service of this publication and the Consumer Information Center of the U. S. General Services Administration


TA ELECTRONICALLY
AVE TIME
POOR DISTRIBUTION MAY CAUSE PLATING AND ETCHING PROBLEMS
CHANGING THIS DIMENSION .100" WILL SUBSTANTIALLY IMPROVE COST
DFM CHECK SHOWS FAB DWG AND GERBER DATA ARE DIFFERENT
MAY INCREASE COST AND CAUSE WARP AND TWIST DURING SMT ASSEMBLY
DFM CHECK SHOWS TIGHT HOLE-TO-PAD RATIO, POSSIBLE BREAKOUT CONDITION
HOLE CHART
PRIMARY SIDE
SECTION A—ASH2
SCALE: NONE
(CROSS SECTIONAL VIEW OF 6 LAYER BOARD)

WE CAN DO ANYTHING YOU ASK, BUT SOMETIMES WE'D RATHER NOT.

Please don't get us wrong.

Praegitzer Industries can fabricate bare boards with high layer counts. Fine lines down to and below 4 mils. Holes ten mils in diameter and smaller. Even buried capacitance. In short, we can build just about any board you can design—on time and on budget.

But first, we look for ways to make your board design easier to manufacture, higher in quality, and more cost effective. We not only make your board, we make it better.

It's a concept we call value-added fabrication.

How does it work? First, we call on the extensive expertise in our design division. Our designers have created high-speed, multilayer boards for scores of leading manufacturers. As a result, they know how to use the latest design tools and techniques to help you identify ways to reduce layers. Simplify assembly. Or control impedance.

At the same time, the fab engineers can help you evaluate the tradeoffs of our advanced processes, and suggest design alterations that improve fabrication efficiency.

As a result, we don't just build what you ask. We give you what you want: the board that makes your end product most successful.

See for yourself how value-added fabrication at Praegitzer Industries can help you create more competitive products.

Call **1-800-875-2522** today for this free video and literature.

Circle 190 For Literature (U.S. Response)
Circle 191 For Literature (Response Outside the U.S.)

Praegitzer Industries
The Fine Line in Printed Circuits
1270 Monmouth Cut-Off, Dallas, Oregon 97338-9532

BOARD TESTER HANDLES MULTIPLE STRATEGIES

The GR2756 Integrated Flex-Strategy Test System is well-suited for testing and diagnosing complex boards that exhibit both process-related and product performance faults. The tester comes with data rates of 10 or 20 MHz (interleaved) and supports several pin board types up to 3328 universal pins. The system is test-program and fixture-compatible with other GR275X testers. The GR2756 works with the Genesis test framework, which includes a complete set of automatic test and diagnostic development tools. The software generates programs for in-circuit, boundary-scan, functional, and emulation tests and diagnostics. GR2756 prices start at $355,000, including pin board and software. JN

GenRad Inc., 300 Baker Ave., Concord, MA 01742-2174; (508) 369-4400, ext. 2308. **CIRCLE 741**

SCOPE SAMPLING MODULE BOASTS 4-GHZ BANDWIDTH

A dual-channel plug-in sampling module for the 7200-series modular oscilloscopes uses low-noise GaAs/AlGaAs heterojunction bipolar transistors (HBT) to deliver an analog bandwidth greater than 4 GHz. The 7262 features 10-bit resolution and a 40-Msample/s sampling rate. The equivalent sample rate for repetitive signals is 100 Gsamples/s. Internal and external trigger bandwidths are in excess of 2.5 GHz. A built-in generator delivers pulses with less than 100-ps transition times for use in time-domain reflectometry. Internal TDR software provides readouts in distance and impedance. The module stores 20,000 samples. The 7262 costs $12,390, with delivery in six to eight weeks. JN

LeCroy Corp., 700 Chestnut Ridge Rd., Chestnut Ridge, NY 10977-6499; (914) 425-2000. **CIRCLE 742**

ANALYZER-BERT COMBO TESTS HIGH-SPEED LINKS

A combination parallel bit-error-rate tester (BERT) and protocol analyzer, the GLA-2000 tests parallel interfaces for serial data links to 1.25 Gbits/s. The system works with Fiber Channel, HiPPI Serial, Sonet, and SCI links. The parallel BERT capability with protocol triggering and chip-set-specific controls lets users test all parallel I/O lines simultaneously while triggering, capturing, time-stamping, and analyzing data. Protocol analyzer functions include the ability to define data patterns, set triggers, capture blocks of data, and time-stamp events in a passive listening mode. The GLA-2000 costs $15,400. Interface cards for specific protocols and chip sets range from $1500 to $4100. JN

Finisar Corp., 3515 Edison Way, Menlo Park, CA 94025; (415) 364-2722. **CIRCLE 743**

Label Your Printed Circuit Board Permanently in Silicon

- ► DS2401 Silicon Serial Number has 64-bit registration number laser-engraved in silicon
- ► ID chips pick and place like other PCB components
- ► Track PCB through manufacturing and then use the digital ID for the life of the product
- ► The number can be read by other digital circuits on PCB for display or network node ID
- ► Low-cost SOT-223 (DS2401Z) surface mount or TO-92 (DS2401) package
- ► Guaranteed unique: 10^{19} numbers available
- ► Each chip registered and tested before shipping
- ► Only one signal plus ground
- ► Powered from the incoming signal; zero standby power
- ► Extended 2.8 to 6.0 voltage range
- ► Use the DS2405 Silicon Serial Number plus 1K EPROM for adding your own information

Actual size

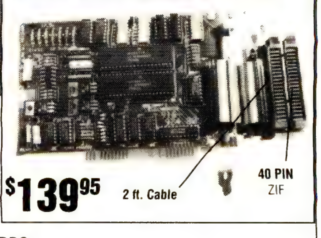
*For a **FREE!** sample, call (214) 450-0448 or FAX us at (214) 450-3715.*

DALLAS SEMICONDUCTOR
4401 South Beltwood Parkway
Dallas, Texas 75244-3292

CIRCLE 110 FOR U.S. RESPONSE
CIRCLE 111 FOR RESPONSE OUTSIDE THE U.S.

Device Programmers

PB-10 Internal Card for PC



- Easy to use software, on-line help, full sceen editor
- **Made in USA**
- 1 & 2 Year Warranty
- Technical Support by phone
- 30 day Money Back Guarantee
- FREE software upgrades available via BBS
- Demo SW via **BBS (EM20DEMO.EXE) (PB10DEMO.EXE)**
- **E(e)proms** 2716 - 8 megabit, 16 bit 27210-27240, 27C400 & 27C800,
- **Flash** 28F256–28F020, (29C256–29C010 (EMP-20 only))
- **Micros** 8741A, 42A, 42AH, 48, 49, 48H, 49H, 55, 87C51, 87C51FX, 87C751,752
- **GAL, PLD** from NS, Lattice, AMD-**16V8, 20V8, 22V10** (EMP-20 only)

FOR MORE INFORMATION CALL

NEEDHAM'S ELECTRONICS, INC.

4539 Orange Grove Ave.
Sacramento, CA 95841
(Monday-Friday, 8 am-5 pm PST)

MasterCard VISA
C.O.D.

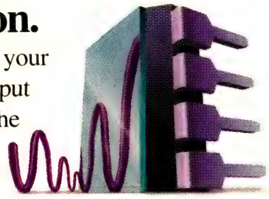
(916) 924-8037
BBS (916) 972-8042
FAX (916) 972-9960

CIRCLE 172 FOR U.S. RESPONSE
CIRCLE 173 FOR RESPONSE OUTSIDE THE U.S.

Because you're thinking fast…

Pick your path to affordable high speed op amps.

Low harmonic distortion.



To reproduce your high-speed input signals with the greatest signal purity, choose from op amps such as the 350MHz CLC409, which delivers -65/-72dBc 2nd/3rd order harmonics at $2V_{pp}$, 100Ω, 20MHz. Plus a half dozen others with less than -50dBc distortion.

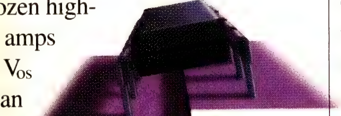
Fast settling time.

Our wide range of high-speed op amps gives you a choice from 8-bit to 14-bit settling. They range from the 350MHz CLC409 with a fast 8ns to 0.1% to the 195MHz CLC402 with a blazing 18ns to 0.0025%.

Low power consumption.

Want high speed with low power? Choose from op amps like the 350MHz CLC409 with 135mW power dissipation, the 160MHz CLC406 at 50mW, the 300MHz CLC420 at 40mW, or the 50MHz CLC505 at 10mW, which lets you set supply current over a range of microamps to milliamps with a single resistor.

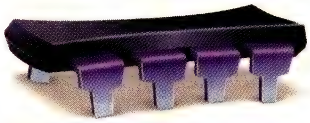
Low offset voltage.



A half-dozen high-speed op amps give you V_{os} of less than 1mV. For example, the 1.7GHz GBW CLC425 delivers a low 100μV offset. The CLC402 and CLC409 provide V_{os} of 500μV. And nearly a dozen other fast op amps have less than 2mV offset.

Low noise.

With its ultra-low $1.05\text{nV}/\sqrt{\text{Hz}}$ input noise, the CLC425 is the lowest-noise wide-band op amp on the market. Close behind is the unity-gain stable CLC426 with $1.4\text{nV}/\sqrt{\text{Hz}}$ input voltage noise. Followed by more than a dozen with e_n less than $3.0\text{nV}/\sqrt{\text{Hz}}$.



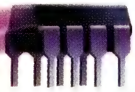
Wide bandwidth.

Choose from our large family of dc-coupled wideband op amps. From the 55MHz CLC430 and the 350MHz CLC409 current-feedback op amps, to the 1.7GHz GBW CLC425 and the 5.0GHz GBW CLC422 voltage-feedback op amps.

High gain.

Our large family of current-feedback op amps deliver nearly constant bandwidths over their gain ranges. For example, the CLC401, at a gain of +20V/V, gives a 150MHz -3dB bandwidth. And the voltage-feedback CLC422, with its 5.0GHz GBW, delivers the widest gain bandwidth product on the market.

Fast slew rate.



Speed is our specialty, so you'd expect performers like the 175MHz CLC404, which delivers 2600V/μs and a $5V_{pp}$ output signal. Or the 200MHz CLC411, a 15V op amp at 2300V/μs. Plus nearly a dozen more with specs greater than 1000V/μs.

Prices you can afford.

Pricing on our high-speed op amps is very competitive. And you'll find significant quantity discounts. Take a look, because we have dozens of fast op amps to choose from. Plus applications engineers that are ready to help you with product selection and design troubleshooting.

For details, call or fax our European sales office and ask for our new "Solutions with Speed" data book and FREE macromodels. Then you can explore your own path to high speed.

Comlinear Corporation

Solutions with speed

4800 Wheaton Drive
Fort Collins, CO 80525
(303) 226-0500
1-800-776-0500 (USA)

For more information, Contact Comlinear Europe Ltd.
15 Mercia Business Village, Westwood Business Park, Coventry
CV4 8HX, England. Phone 44 203 422958, Fax 44 203 422961

© 1993 Comlinear Corporation

CIRCLE 107

FAST HDL SIMULATOR HAS 100% VERILOG SUPPORT

VCS 2.0, the latest version of Chronologic's Verilog simulator, has complete support for the Verilog hardware description language. The 100% Verilog support means that VCS users have access to over 135 design kits from more than 29 ASIC vendors. Version 2.0 also adds gate-level timing features, an interactive debugging environment, full PLI support, and faster simulation speed. VCS is a compiler, rather than an interpreter, for the Verilog language. The company claims that using the compiled-code approach, VCS can run 40 times faster than the first-generation Verilog simulator from Cadence. VCS 2.0 runs on Unix workstations. It will ship in the third quarter for $30,000. LM

Chronologic Simulation, 5150 El Camino Real, Suite D-31, Los Altos, CA 94022; (415) 965-3312. CIRCLE 744

SPICE IS PACKAGED FOR VARIOUS USER LEVELS

The SpiceAge circuit-simulation program for Windows is packaged in three capability levels with varying price tags. At one end of the spectrum, a low-cost, starter version of the software puts a Windows-based Spice simulator within reach of the student, hobbyist, and beginner circuit designer. This is the Level 1 package. As users' circuit complexity and design skills increase, they may move up in analytical power and circuit capacity to more advanced levels of the program without having to re-train or re-do any prior modeling files. At the high end, a Level 7 package lets the basic component library be augmented with Spice models offered by semiconductor manufacturers. The third level, Level 3, has capability and capacity somewhere between the other two packages. SpiceAge runs on PCs under Windows. Pricing for the three versions is $100, $895, $1160. LM

Tatum Labs Inc., 1287 N. Silo Ridge Dr., Ann Arbor, MI 48108; (313) 663-8810. CIRCLE 745

HARDWARE ACCELERATOR USES 256 PROCESSORS

The NSIM hardware accelerator from Ikos increases the capacity and speed of gate-level simulation within the company's mixed-level VHDL environment for designs with as many as 16 million primitives. It uses up to 256 processors, each of which boosts simulation by 10 million events per second and handles 64,000 modeling primitives. NSIM is a third-order hypercube machine, and its underlying architecture optimizes performance by keeping the processors busy and minimizing communication time between processors. To accommodate large engineering teams, the accelerator supports 16 simultaneous users and provides reconfiguration under software control. Accuracy is ensured with over 80 certified ASIC and FPGA libraries. The NSIM hardware accelerator will ship in September. Pricing varies with configuration. For example, a 192,000-primitive version costs $65,950. LM

Ikos Systems Inc., 19050 Pruneridge Ave., Cupertino, CA 95014; (408) 255-4567. CIRCLE 746

SYSTEM TOOL SUPPORTS MULTI-VALUE LOGIC

The latest version of the ExpressV-HDL system-design tool supports IEEE-standard multiple-value logic (MLV-9). In addition, ExpressV-HDL will support any value logic that the user defines. This allows design engineers to develop models and code that can be linked from different sources, such as libraries and other tools. Version 2.5 also includes more built-in testability and is more user configurable than previous versions. ExpressV-HDL is a front end for traditional EDA environments. It provides ASIC design engineers with a graphical environment for behavorial analysis and simulation. Graphical modeling is based on standard state-chart notation. After analysis, engineers automatically generate VHDL or Verilog code tailored to a specific HDL simulator. ExpressV-HDL 2.5 runs on Unix workstations. It's shipping now at a single-seat price of $32,500. LM

i-Logix Inc., 22 Third Ave., Burlington, MA 01803; (617) 272-8090. CIRCLE 747

BOARD DESIGN PACKAGE ADDS CURVED TRACES

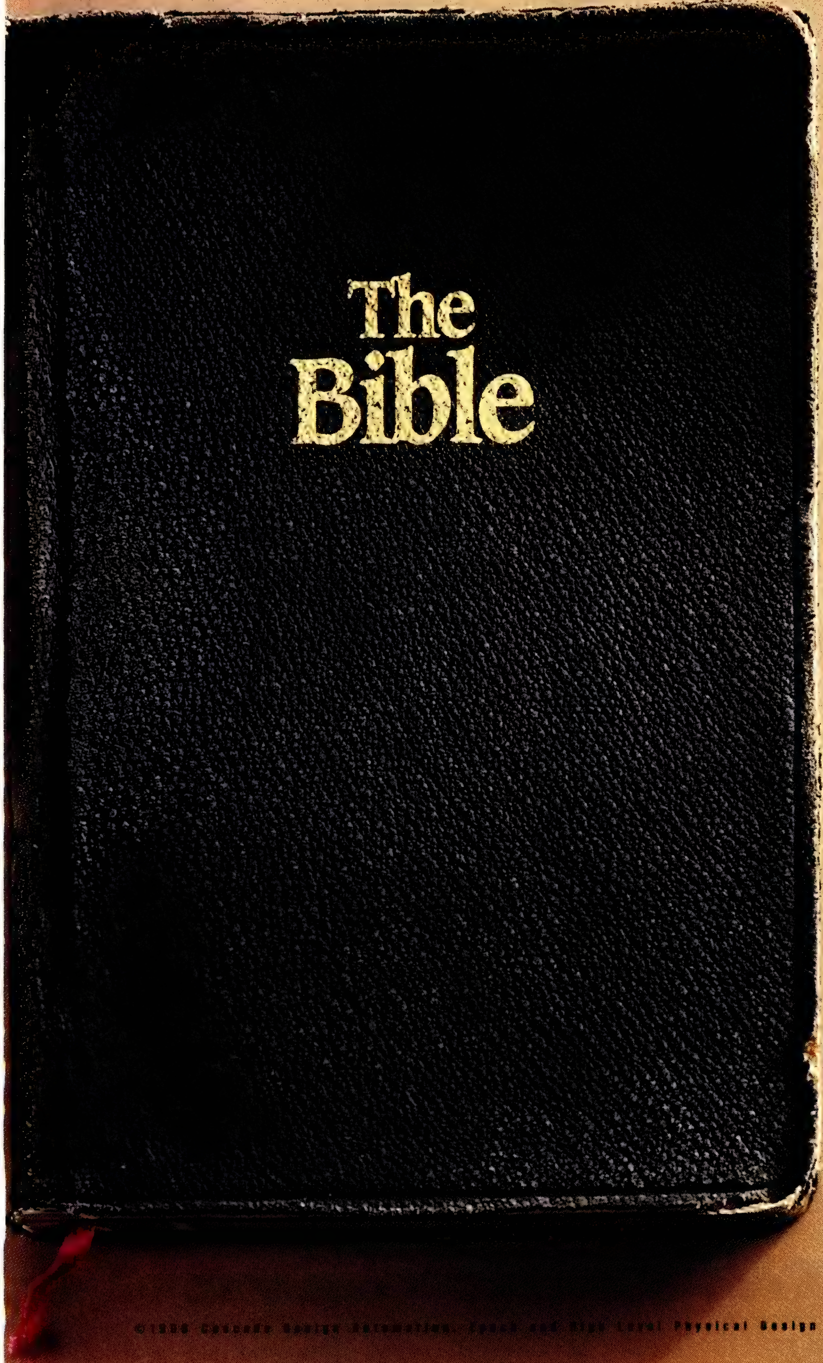
Support of curved traces is one of the many features added to an improved version of the HiWire II integrated schematic-capture and pc-board layout system. Other improvements include patterned area fill, PCX-graphics output, and automatic generation of photoplotter data. PCX-graphics file output eases the task of importing HiWire drawings into word-processed documents. Existing export options include PostScript, HP-GL, and DXF files. Pricing for the personal-computer-based HiWire II software without the autorouter is $995. With an autorouter, HiWire II pricing ranges from $1995 to $2395. LM

Wintek Corp., 1801 South St., Lafayette, IN 47904-2993 (800) 742-6809 or (317) 448-1903. CIRCLE 748

SCHEMATIC TOOL HAS WINDOWS VERSIONS

The latest version of the PC-based Schemax schematic-capture program is now available in 16- and 32-bit configurations for Windows 3.1 and Windows NT, respectively. In addition, Schemax has added library print and plot routines for creating listings or catalogs of library parts, true-type font support, and ASCII drawing-file output. An optional module imports the schematic net lists of other vendors, and reconstructs them in Schemax. Users can rearrange parts and draw unknown parts before an autorouter completes the reconstruction by drawing wires between pins or labels. Schemax is shipping now for $595. The optional net-list import/routing module goes for $149. LM

Omation Inc., 801 Presidential Dr., Richardson, TX 75081; (800) 553-9119 or (214) 231-5167. CIRCLE 749



The Next Time They Swear Their Physical Design Tools Can Perform Miracles, Make Them Swear On This.

You've heard it all before. Integrated EDA tools that magically give you finished back end design. True performance-driven layouts with your eyes closed. Complex submicron ASICs out the door in no time flat.

Dig a little deeper and you'll find that most of these claims simply won't stand up in court. And after paying a high price in multiple iterations, NRE and scrambled schedules, you'll be ready to swear an oath of your own.

Here's the whole truth and nothing but the truth: Only Epoch™ gives you true High Level Physical Design.™ It's a unique, standards based system that's having the same impact on back end design that synthesis is having on the front end. It fully supports VHDL and Verilog, and it's compatible with other popular design environments.

Epoch is a seamless, completely automated solution. As you work top down, it produces bottom-up physical design. With all the performance and accuracy you need, even for complex layouts below .5 micron. And about ten times faster than anything you've seen before. Just think about what that can do to your time-to-market (or maybe even your next review).

Now if you're still a little skeptical, we understand. All we ask is a chance to present our case. Call us at 800-258-8574 (Department M4) for a brochure.

Then you can judge for yourself.

CASCADE
DESIGN AUTOMATION

©1993 Cascade Design Automation. Epoch and High Level Physical Design are trademarks of Cascade Design Automation.

CIRCLE 102 FOR U.S. RESPONSE

CIRCLE 103 FOR RESPONSE OUTSIDE THE U.S.

SCHEMATIC SOFTWARE AND SIMULATOR TEAM WITH I/O BOARD TO CREATE VIRTUAL HARDWARE

A Windows-based design package from Aldec converts schematics into virtual hardware capable of operating in a closed loop with any target system. The product, called Virtual Hardware Schematic (VHS), consists of a schematic editor, background logic simulator, and an I/O interface board. VHS accepts the same Jedec, hex, and XNF design files that designers use with real hardware.

Each schematic entry is fed into the on-line background simulator, which creates an equivalent electronic breadboard in the computer's memory. Then, the electronic breadboard directly interacts with any external hardware system through the I/O board. Designers using the schematic editor can dynamically assign I/O pins on the interface board as either inputs or outputs.

With VHS, users can simulate a board with the actual ICs in place of software models. Called hardware modeling, the process is implemented by feeding the model's input signals to the input pins of the actual device located within the target system. The response generated by the actual device is then fed from its outputs into the corresponding pins of the missing IC model. All signal transfers going in and out of the Virtual Hardware Editor pass through the I/O board.

Another VHS application is industrial control. Designers describe all control operations with schematics, Boolean equations, or VHDL language statements. These entries are then emulated by VHS, which directly controls the external equipment through the I/O board. Dedicated software utilities help users create the control panels.

VHS runs on PCs under Windows, and includes the schematic editor, simulator, 24-channel I/O board, and TTL-components library. Introductory pricing is set at $795. Additional libraries cost $495 each. Upgrades include hierarchical-design support and 48- through 192-channel interface boards. VHS will ship at the end of the month.

Automated Logic Design Co. Inc., *3525 Old Conejo Rd #111, Newbury Park, CA 91320; (805) 499-6867.* **CIRCLE 750**

■ *LISA MALINIAK*

INTERFACE LINKS PLD AND SYNTHESIS TOOLS

A new interface lets users of Synopsys high-level design tools exploit the PLD software from Minc. The Library Interface consists of a Minc-specific target library for Synopsys' DC Expert, DC Professional, and FPGA Compiler software that lets users target designs to Minc's system via an EDIF net list. As a result, engineers can process VHDL and Verilog designs in the Synopsys high-level design system and pass them to Minc's PLDesigner-XL for implementation in programmable architectures. The Interface also works in the reverse direction, allowing PLDesigner users to migrate their multiple-device programmable-logic designs to the Synopsys system for design re-use and migration to ASIC architectures. Typical applications for the interface include VHDL or Verilog-language design entry for PLDs, as well as ASIC prototyping. The Synopsys Library Interface, which is available now, is sold and supported by Minc. Call for pricing and additional information. LM

Minc Inc., 6755 Earl Dr., Colorado Springs, CO 80918; (719) 590-1155. **CIRCLE 751**

TIMING DRIVES ASIC TOP-DOWN ENVIRONMENT

ASICPlan is a vendor-independent floorplanning tool from Mentor Graphics that's tightly meshed with the company's top-down design environment. The floorplanner estimates pre-layout interconnect delays to help with timing-driven layout for submicron sea-of-gates and gate-array technology. It also does hierarchical net-list analysis and physical-component grouping of designs. Relevant net-list data is extracted through the company's Electronic Design Data Manager, and back annotated with an ASCII file. Engineers can then resynthesize a design with Mentor's AutoLogic software using the back-annotated values for optimized results. Physical-grouping information and timing constraints can be forwarded to any place-and-route tool. Users can select clustering options to construct a hierarchy tree representing the physical layout of the chip. ASICPlan runs under Unix. It will ship by year's end for $30,000. LM

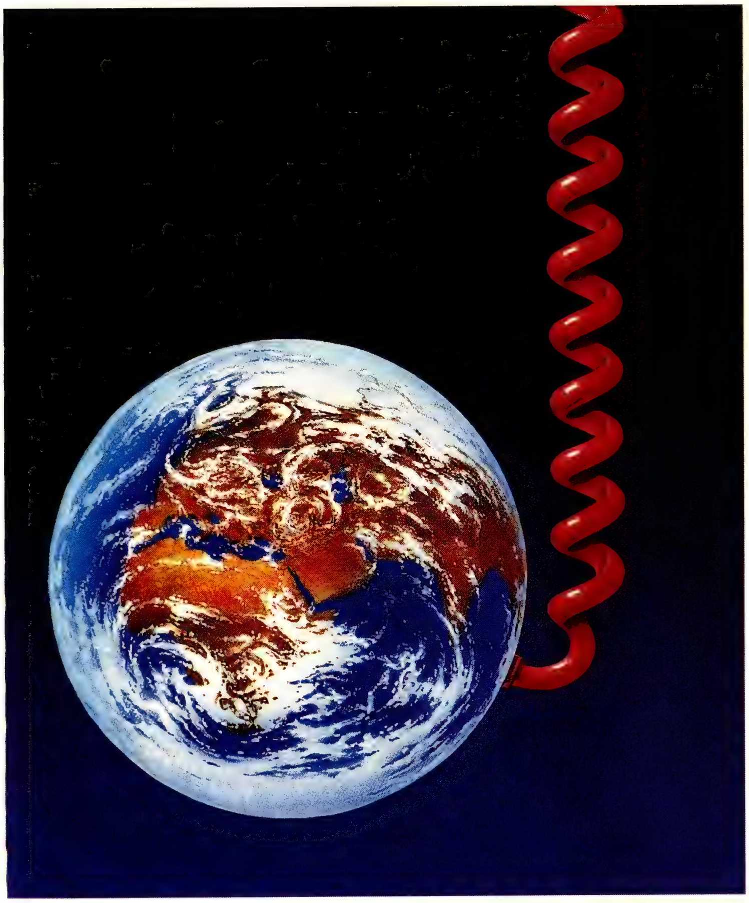
Mentor Graphics Corp., 8005 S.W. Boeckman Rd., Wilsonville, OR 97070-7777; (503) 685-7000. **CIRCLE 752**

INTERFACES LINK HSPICE TO A VARIETY OF TOOLS

A group of software interfaces called HotLinks will link Meta-Software's HSpice circuit simulator with a variety of design tools from Cadence Design Systems. The three separate interfaces are built on top of MetaManager, an HSpice simulation manager and graphical user interface. One of the interfaces joins HSpice with the Composer schematic editor, one with the Verilog-XL digital simulator, and one with the LPS and LVS integrated-circuit layout-verification tools. In addition, another interface tightly meshes HSpice with Cadence's set of analog tools. All HotLinks provide native-mode integration into Cadence's framework environment. HSpice and HotLinks interfaces run on Unix workstations, and on personal computers with or without Windows. Composer Link is shipping now for $5000. Verilog Link will ship by the end of the year, and Verification Link will be available in early 1994. LM

Meta-Software Inc., 1300 White Oaks Rd., Campbell, CA 95008; (800) 346-5953 or (408) 369-5400. **CIRCLE 753**

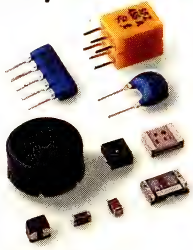
Designing telecommunications equipment? Here's how to put your world on a string.



Quite simply, tap into the proper sources. Because, while in one sense the world's a lot smaller, it can seem pretty big when the support you need is on the other side of it.

It needn't be that way in passive components. Because Murata Erie's always nearby. Whether you're building Global Positioning Systems in Singapore, RF modems in Milan, or telephone systems in Thailand.

And we're there in a big way. With the technical expertise that ensures speed and flexibility in meeting new design requirements. With the high-volume manufacturing and distribution resources that – in getting parts where and when you need them – shrink the world to "neighborhood" size. And, of course, with undisputed Murata Erie quality, backed by our unique 1.0 QRS (100% quality, reliability, service) program.



Oh, yes – product line breadth. You'll find our line, the largest, from chip caps to piezoelectric gyroscope systems, can make a world of difference in calculating the economic rewards of vendor reduction efforts.

Call or write for details: Murata Erie North America, Marketing Communications, 2200 Lake Park Drive, Smyrna, GA 30080; 1-800-831-9172, Fax: 1-404-684-1541. Because, if it's the telecommunications world you're after, you'll want to string along with us.

muRata ERIE®

MURATA ERIE NORTH AMERICA

Delivering Technology Worldwide℠

CIRCLE 250 FOR U.S. RESPONSE

CIRCLE 251 FOR RESPONSE OUTSIDE THE U.S.

TOOLKITS HELP DEVELOPING WITH REAL-TIME KERNELS

Integrating existing code for real-time and embedded systems with sophisticated development tools should be easier with two toolkits from Ready Systems. KernelIntegrator is aimed at integrating in-house kernels with Spectra, Ready's open cross-development backplane. KernelBuilder enables developers to build new kernels, emulate existing in-house kernels, and customize Ready Systems' VRTX as a kernel.

With KernelIntegrator, developers interface their kernels to Spectra, which then supplies simultaneous source-level display of multiple tasks; breakpoints that halt only one task; and interactive system call handling from host-based tools. Most kernels can be interfaced to Spectra without modification. The ToolBuilder interface also can be used to implement customized query functions for kernel objects.

KernelBuilder enables developers to build applications programming interfaces (APIs) on the nanokernel. It permits APIs to run on any processor supported by VRTXsa, allows existing code to run with new code, and reduces users' maintenance because Ready maintains the nanokernel. KernelBuilder runs on Spectra's virtual target.

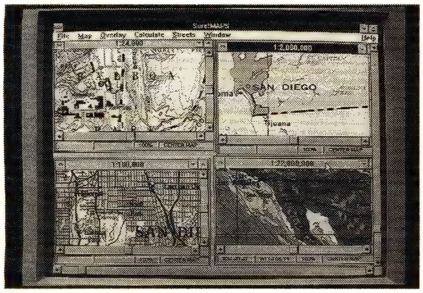
The KernelIntegrator Toolkit includes Spectra RTOS interface and sample source code, training and support. It sells for $30,000. The KernelBuilder toolkit includes the nanokernel, support library, documentation, source code and design documentation for the VRTXsa API, along with training and support. Price depends on support level.

***Ready Systems Inc.**, 470 Potrero Ave., Sunnyvale, CA 94086; (408) 736-2600; fax 522-7197.* CIRCLE 754

■ *SHERRIE VAN TYLE*

CD-ROM SOFTWARE DISPLAYS RASTER MAPS

Sure!Maps mapping software on CD-ROM brings the precision and color details of raster mapping software to PCs running under Windows and DOS. Comparable raster-mapping software sells in the $1500 to $2000 range, yet Sure!Maps is priced to compete with less sophisticated vector-mapping programs. Sure!Maps 2.0's raster mapping can present the shape of large buildings, tunnels, bridges, waterways, and landmarks. Vector-mapping shows only boundary line drawings using criteria such as state, county, or zip code boundaries. The Windows capability allows users to open several scales of a map at the same time, with each map supplying a different level of information. The base product includes a continental U. S. map and two world maps. A library of 22 optional map sets that contain detailed maps for more than 60 U. S. metropolitan areas. Version 2.0 enables a user to import spreadsheet and database files that contain a street address. System requirements are a 386-based PC, 4 Mbytes of RAM, 2 Mbytes of hard disk space, and a Super VGA display; a mouse is recommended. Sure!Maps lists for $199. SVT



Horizons Technology, 3990 Ruffin Rd., San Diego, CA 92123-1826; (619)292-8331;fax-7321. CIRCLE 755

SIGNAL-PROCESSING SOFTWARE GOES FOR $99

The Monarch series of digital-signal-processor software consists of a Digital Filters package ($99), which offers FIR and IIR filter design methods; the Siglab comprehensive interretive DSP language ($99) for signals and systems analysis; the adaptive filters package ($399) offers least mean squared (LMS) and fast recursive least squares (FLS) algorithms with transversal and lattice-ladder for single and multidimensional signals. Code generators ($99) for DSP microprocessors round out the series. SVT

The Athena Group Inc., 3424 NW 31st St., Gainesville, FL 32605; (904) 371-2567; fax (904) 373-5182. CIRCLE 756

TOOL EASES WRITING C APPS FOR WINDOWS

A visual development system for Windows applications streamlines writing C and C++ applications for Windows. ProtoGen+, which replaces the ProtoGen application generator, screen manager, menu designer, library, and dialog editor, can also be used for Pascal applications. The toolset features object-oriented programming and a live, interactive test mode. With built-in simulation capability, developers can test the application before generating the code or compiling the application. The WinControl Library is a versatile, expandable dynamic link library of 14 custom controls that adds to the six standard Windows controls. ProtoGen+ lists at $395 with an introductory price of $199. Upgrades are $79.95. SVT

ProtoView Development Corp., 353 Georges Rd., Dayton, NJ 08810; (908) 329-8588. CIRCLE 757

C++ SOURCE CODE COMES ON CD-ROM

A C++ source-code library on CD-ROM contains at least 140 volumes of C++ source code, shareware, and freeware, including neural nets, communications, matrix/numerical, memory management, tutorials, compilers, graphical user interfaces, databases, graphics, and utilities. Price on CD-ROM is $99.99. Contact the company for availability on 3.5- and 5.25-in. disks. SVT

ImageSoft Inc., 2 Haven Ave., Port Washington, NY 11050; (516) 767-2233; fax -9067. CIRCLE 758

PAPST

This says it all, no fanfare required.

We've always maintained that when you specify PAPST you're getting the world's finest fans and blowers. Now the quality that has made us the choice for the most demanding applications has been confirmed. The PAPST organization in Germany has met the International Standard for Quality, ISO 9001.

That's right. Every process at PAPST from initial design through final inspection meets the rigorous standards of ISO 9001. In a series of extensive sessions, auditors from the German Association for the Certification of Quality Systems thoroughly scrutinized every aspect of PAPST Germany. Clearly, they were impressed with what they saw.

Think about it. The broadest choice of AC and DC tubeaxial fans and blowers available. High performance engineering. Exceptional reliability. Economical and whisper-quiet operation. Worldwide support. The most respected standard for quality around the world - - ISO 9001.

With all these pluses, deciding on which fans and blowers to specify should be something you breeze right through without fanfare. PAPST! For more information and our free catalog call **1-800-245-FANS.**

PAPST MECHATRONIC
CORPORATION
Aquidneck Industrial Park
Newport, RI 02840
Tel 1-800-245-FANS
Fax 1-401-849-3743

SEE US AT WESCON BOOTH # 6153-6155

CIRCLE 252 FOR U.S. RESPONSE

CIRCLE 253 FOR RESPONSE OUTSIDE THE U.S.

NOVELL'S DOS 7 EXTENDS PC CAPABILITIES

Version 7 of Novell's disk operating system features full use of extended memory on an IBM-compatible PC, preemptive multitasking, fully integrated peer-to-peer and client server networking, individual user profiling for security, and an integrated disk data-compression system that uses little application memory.

Novell DOS 7 promises to extend the working life of existing computers and avoid the expense and time involved in enhancing hardware to run Microsoft Windows. For engineers running sophisticated design software, the OS's preemptive multitasking capabilities extend to running high-resolution graphics programs in background mode with a virtual but hidden screen re-drawing while other tasks are performed in the foreground.

At the same time the implementation of DOS Protected Mode Services (DPMS) can free up user memory by shifting device drivers and memory-resident utility programs into extended memory above the 1,064-byte limit usually imposed by PC operating systems. DPMS enables client programs to execute code and store data in extended memory. It uses an application programming interface (API) that allows developers to create DOS system extensions that use the protected mode on Intel 80286-, 80386-, and 80486-based computers.

A $198 developers' kit includes all documentation needed to implement protected mode drivers and resident programs. Use of the API will not incur royalty payments. The multitasking API provides functions for shared memory, interprocess communication through pipes, queues, and semaphores and program execution control. Networking ability has been integrated into Novell DOS 7, supplying a smooth progression from a small network of three computers simply connected in a peer-to-peer configuration to which more and more machine can be added until it becomes a large client server system with peer-to-peer groups as necessary. Conversely, an existing large network can be easily be subdivided into work-groups if required. A major strength is a central distribution, management, and security system that allows a MIS manager to up-grade individual machines on his network from a central server.

Security is managed by defining a user profile for individually named users. That means they can be given levels of access to networked resources based on their own identities rather than on the identity of the computer they are using. User access can also be profiled by time of day.

Novell Inc., *122 East 1700 South, Provo, UT 84606; (801) 568-8800.* **CIRCLE 759**

■ *PETER FLETCHER*

SOFTWARE TACKLES CODE ANALYSIS

Version 2.0 of SmartSystem is aimed at analyzing older, unwieldy programs that may be incomplete, undocumented, and full of bugs and areas that need improvement. SmartSystem analyzes many dialects of C code and code targeted for various Unix platforms and embedded systems; it also gives developers the information they need to make changes without affecting unrelated parts of the code, which reduces the risk in a software project. SmartSystem runs on Hewlett-Packard, IBM, and Sun platforms. Contact the company for pricing information. SVT

Procase, 2694 Orchard Pkwy., San Jose, CA 95134; (408) 433-9500; fax 435-2600. **CIRCLE 760**

SCSI SOFTWARE ENHANCES CD-ROM DRIVES

EZ-SCSI 2.0 is an upgrade to the installation software that makes the task of installing SCSI-based peripherals very simple. The upgrade adds two features that pertain to the use of CD-ROM drives. A Photo CD Viewer lets users select, size, crop, and edit photographic images. Those images can then be exported to other applications.

The included CD Play application supplies an on-screen control panel for playing audio CDs on SCSI CD-ROM drives. A reduced version of this application, Mini CD Play, can remain active at all times. The applications are compatible with most popular CD-ROM drives currently available. EZ-SCSI 2.0 is available now for $75. Registered users of earlier versions of EZ-SCSI can upgrade for $29. The software will be bundled with the company's SCSI host-adapter kits. RN

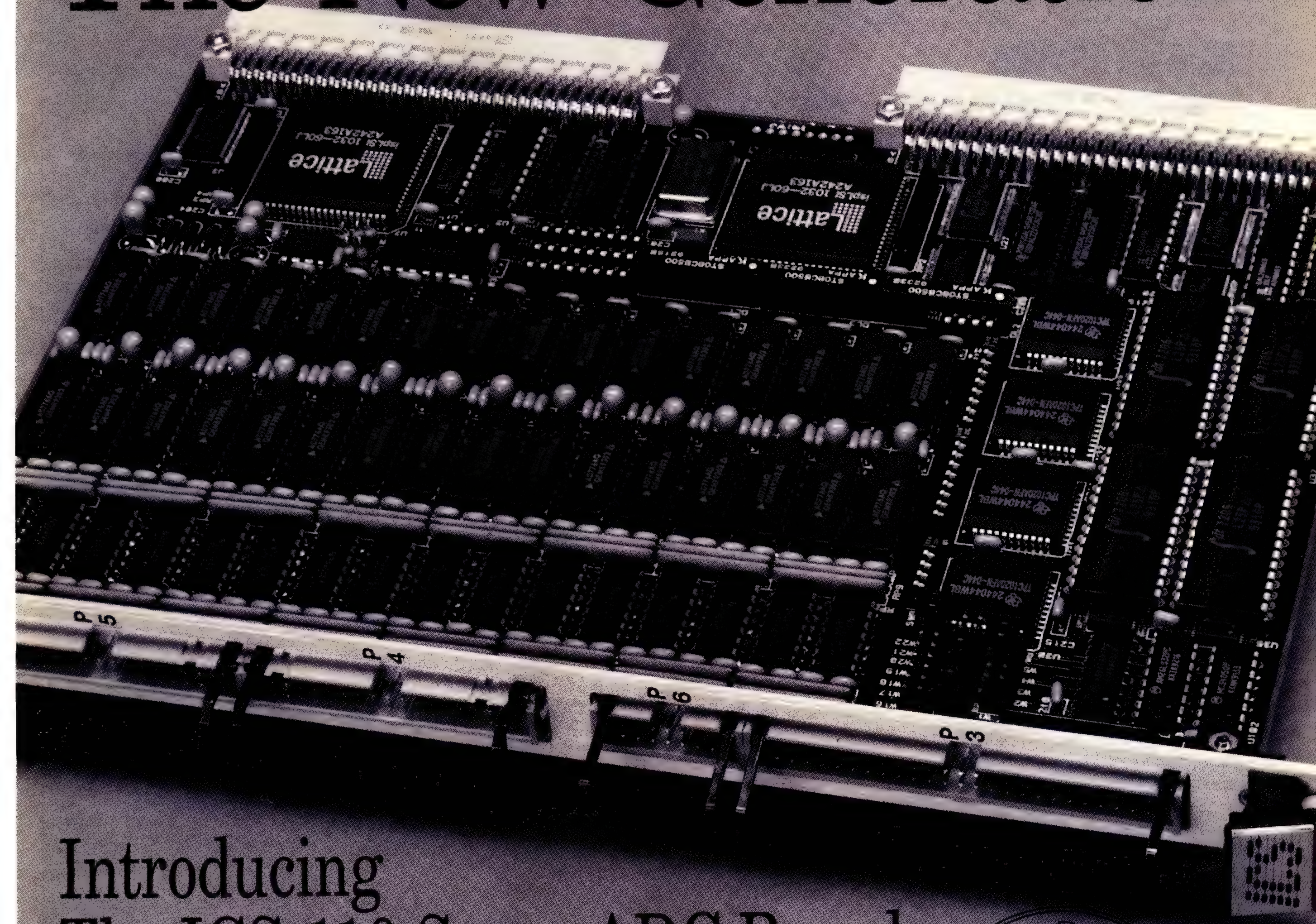
Adaptec Inc., 691 South Milpitas Blvd., Milpitas, CA 95035; (408) 945-8600. **CIRCLE 761**

SOFTWARE LINKS PCMCIA MEMORY TO PORTABLES

Using the CardTrick, any PCMCIA-compatible memory card can be plugged into almost any X86-based subnotebook or portable computer. The software has the ability to access the system's PCMCIA card services or socket services to gain system compatibility. The FAT-style flash file system used by CardTrick lets flash memory be treated like a hard or floppy disk. Or, the flash memory can be configured like write-protected SRAM. Prices for CardTrick vary from under $1 to $10, depending on the number of licenses. A further discount applies when the software is bundled with ROM-DOS, a ROM-based DOS-compatible operating system designed for portables. RN

Datalight Inc., 307 North Olympic Ave., Suite 201, Arlington, WA 98223; (206) 435-8086. **CIRCLE 762**

The New Generation



Introducing
The ICS-110 Super ADC Board

GUARANTEED • 90dB • PERFORMANCE •

32-Channel, 100 KHz/Channel Sigma-Delta Analog Input Board with Full 16-Bit Resolution, VME, VSB and Front-Panel Sky and Mercury Interfaces.

Features:

- Little or No Anti-Aliasing Required
- Separate ADC for Each Channel
- Zero Interchannel Crosstalk
- Differential Inputs
- 90 dB Dynamic Range
- Available in any Number of Channels (Up to 32)
- Simultaneous Sampling at Rates Up to 100 KHz/channel
- Internal/External Clock and Internal/External Trigger
- 64K Words of On-board Storage
- Both VMEbus and VSBbus Interfaces Support Interrupt and 32-Bit Data Transfer
- 16-Bit Front-Panel Port Allows Direct Interfacing to Sky or Mercury i860 Board
- Front-Panel Output Port Data from Multiple ICS-110 Boards can be Bussed
- Front-Panel Synchronizing Signals Guarantee Simultaneous Sampling when Multiple ICS-110 Boards are Used

"When it comes to High-Performance Data Acquisition, we have no competition."

Call Us Toll Free for a Free Catalog:

1-800-267-9794

Telephone: (613) 749-9241 Fax: (613) 749-9461

INTERACTIVE
CIRCUITS AND
SYSTEMS LTD.

CIRCLE 258 FOR U.S. RESPONSE

CIRCLE 259 FOR RESPONSE OUTSIDE THE U.S.

RANDOM NUMBER LIBRARY HAS MANY USES

The Random Number Library can be used to simulate natural events, run Monte Carlo simulations, and explore statistical methods. Unlike random numbers generated by other products, which may contain hidden patterns and that always repeat at unknown intervals, the library contains truly random numbers, its maker says. Users may order any number of volumes of random numbers so that the random number file can be extended to any length desired. The first volume is available as shareware. Contact the company for pricing of other volumes. SVT

Phoenix Technologies of Minnesota, 119 Benton Oaks Dr., Sauk Rapids, MN 56379; (612) 253-0591. **CIRCLE 763**

VXWORKS SUPPORTED ON VMEBUS BOARDS

The latest version of Wind River's real-time OS, VxWorks 5.1, has been ported to a wide range of VMEbus hardware from PEP Modular Computers. The early ports are available free or at low cost to annual maintenance upgrade customers as board-support packages (BSPs). VxWorks 5.1 has Posix support in an ANSI-C-compliant package; a wide range of configurable, scalable modules; new protocols that enhance networking; and an improved compiler that generates faster code, especially for 680x0 and 683x0-based products. Version 5.1 has a multiprocessor-support package, virtual-memory interface, and an improved windX GUI client package with Motif support. The board-support packages will be supplied free or at nominal cost to upgrade customers who purchase VxWorks 5.1 with annual maintenance. For new customers, one BSP is included in the price of Wind River's Development System when purchased from PEP; additional BSPs are $1500 each. SVT

PEP Modular Computers, 750 Holiday Dr., Bldg. 9, Pittsburgh, PA 15220-2783; (800) 228-1737; (412)921-3322;fax-3356. **CIRCLE 764**

SOURCE-LEVEL DEBUGGER RUNS UNDER WINDOWS

A source-level debugger for the company's in-circuit emulators for the Z180 and 80186 processor families, SLD for Windows brings Windows flexibility to embedded firmware. Each of the debugger's windows (source, disassembled code, traced instructions, memory, registers, and so on) can be opened and closed, scrolled, and sized. SLD for Windows supports all the emulator's features, including overlay RAM, extensive complex breakpoints, bus monitor, real-time trace, and performance analysis. SLD for Windows supports all C compilers and assemblers for the 186, Z180, 68000, and 68HC16 processors. A UEM emulator with SLD for Windows costs from $5500 to $7500 and is available from stock. SVT

Softaid Inc., 8300 Guilford Rd., Columbia, MD 21046; (800) 433-8812 or (410) 290-7760. **CIRCLE 765**

FLOW-DIAGRAM EDITOR PORTED TO SOLARIS

Version 7.5 of Robochart, a mouse-driven flow-diagram editor, includes native Solaris 2.x support and output formats that include PostScript, EPSF, MIF, HPGL, and ASCII. New to this version are text search and replace-and-label reformatting commands, drag-and-drop instant access to object and flow types, more mouse and keyboard shortcuts, and more customization options. Robochart runs on Sparc systems under Open Windows 3 with node and floating license options. The first node license is $495, with additional licenses $125 each. SVT

Digital Insight, P.O. Box 533, Simi Valley, CA 93062-0533; (805) 583-3627; fax -3809. **CIRCLE 766**

SVGA EVALUATOR SUPPORTS WINDOWS NT

Because the super VGA (SVGA) version of the Evaluator automated testing tool is operating-system independent, Windows NT-based software can be exhaustively tested with it. With the SVGA Evaluator, resolutions of up to 1024 by 768 by 256 colors are supported on the system under test. Installed into the system under test, the SVGA Evaluator target card connects to the current graphics card through a standard connector, supplying a nonintrusive testing environment. In addition, the product enables designers to perform compatibility testing of PC-based graphics adapters and other hardware devices. SVT

Eastern Systems Inc., P. O. Box 310, Hopkinton, MA 01748; (508) 435-2151; fax -2517. **CIRCLE 767**

PACKAGE AIMS AT EMBEDDED NETWORKS

Aimed at simplifying design for networked embedded applications, the Open Protocol Embedded Networking (OPEN) package supplies a simple interface between pSOSystem-based embedded applications and any networking protocol available in a standard STREAMS-compatible version.

In developing networked applications under the OpEN environment, software engineers need write only the pSOS application to address OpEN's industry standard sockets or Transport Library Interface application-to-OpEN interface, which connects with OpEN's STREAMS-compatible layer, which supplies a standard link with most networking protocol stacks.

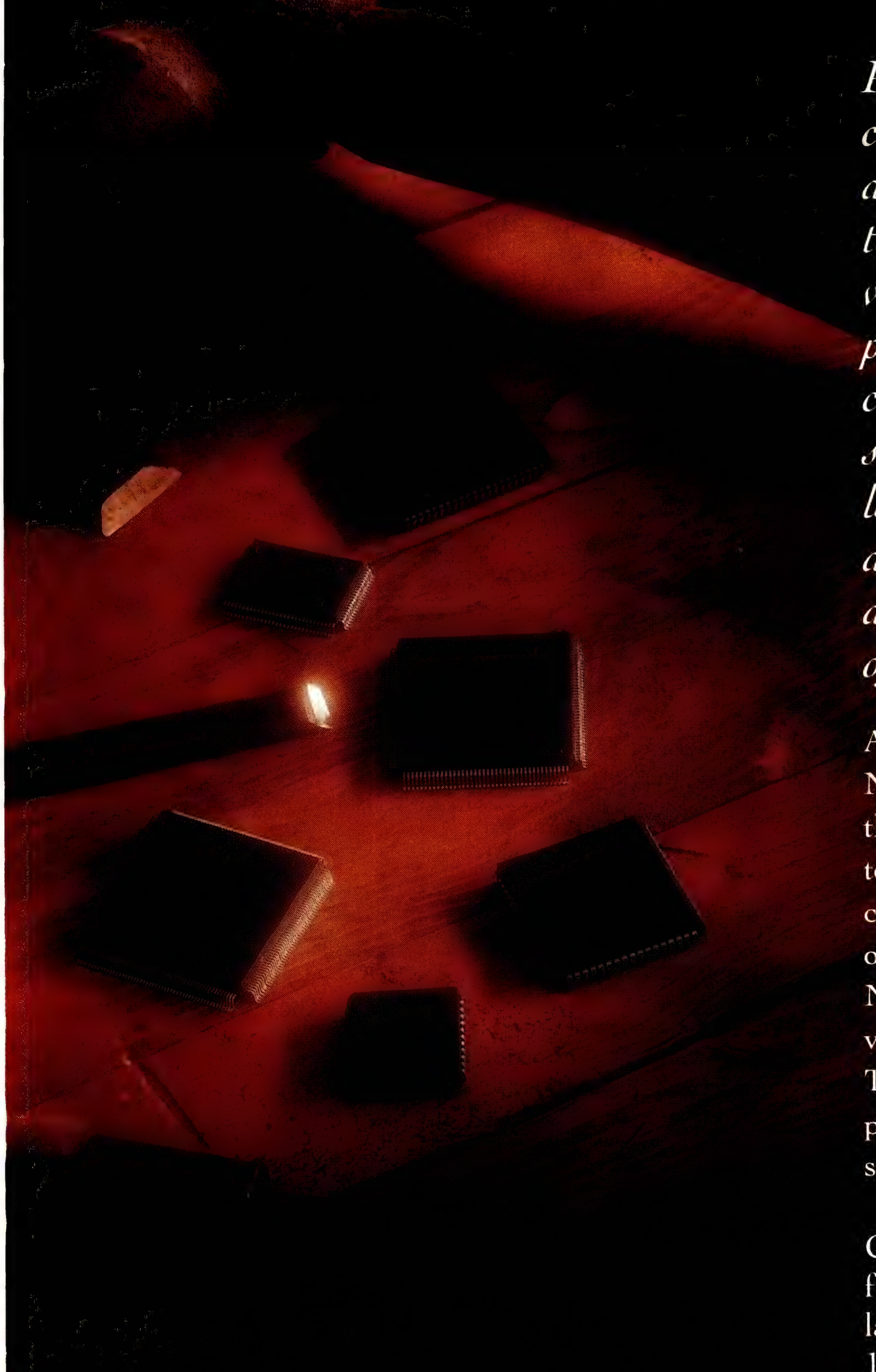
What's more, developers may connect OpEN protocol stacks to pSOSystem network device drivers to integrate applications with various network topologies, including Ethernet, serial connections (SLIP, PPP protocols) shared memory/backplanes, and so forth.

The base price for pSOSystem/OpEN begins at $4000, with shipping slated to begin in November. OpEN runs on Motorola 68000 and Intel i960 microprocessor families, with support for Intel i386/486/Pentium processors set for early 1994. SVT

Integrated Systems Inc., 3260 Jay St., Santa Clara, CA 95054-3309; (408)980-1500;fax-0400. **CIRCLE 768**

NCR

The benchmark of silicon technology.



Pride...
craftsmanship...
a continuing dedication
to excellence...
value driven service...
products designed for the
customer's need, not the
supplier's convenience...
leadership...
a long term commitment...
a vision in every aspect
of our field...

All of this combined has made NCR Microelectronic Products the industry's benchmark for silicon technology. Our quest is to constantly challenge ourselves... our industry. For over three decades, NCR has balanced these traditional values with the latest technology. To see the results – take a look at the products that are setting industry standards.

Call today for a
free copy of our
latest catalog.
1-800-334-5454

CIRCLE 266 FOR U.S. RESPONSE

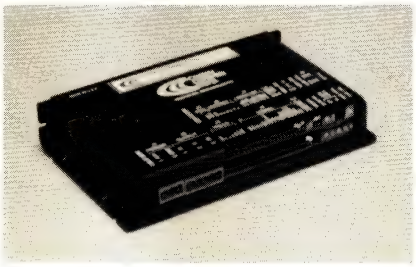
CIRCLE 267 FOR RESPONSE OUTSIDE THE U.S.

2.3-KW SERVOAMPLIFIER PRODUCES RESOLVER FEEDBACK

Thanks to surface-mounted construction, a 2.3-kW servoamplifier incorporates resolver shaft-position feedback as an alternative to an optical shaft encoder. The Model 513R servoamplifier also drives dc-brushless or dc-brush servomotors rated from ±20 to ±180 V.

Traditionally, robotic systems have used optical shaft encoders, mechanically linked to the motion-control system's drive servomotor, to provide continuously updated position signals. Shaft encoders, with their internal light sources, photo sensors, delicate optical disks, and digitizing circuits, typically have MTBF specifications in thousands of hours. In contrast, resolvers, which are basically little more than a rotary transformer, have MTBF specs orders of magnitude greater.

Owing to its simplicity, the Model 513R servoamplifier's resolver is a highly reliable position sensor. Not only does its output deliver position information to the amplifier, but shaft speed and acceleration can be derived as well. The resolver's sine θ and cosine θ are converted into different forms for purposes of encoder emulation, elimination of the motor's Hall sensors, and to derive velocity feedback.



The servoamplifier develops ±13 A continuously to ±180 V (2.3 kW) and ±26 A peak. Its 25-kHz switching frequency eliminates audible noise from the motor windings and provides 2.5 kHz bandwidth for excellent step response. Fast step response provides the rapid acceleration and braking required by today's pick-and-place speeds.

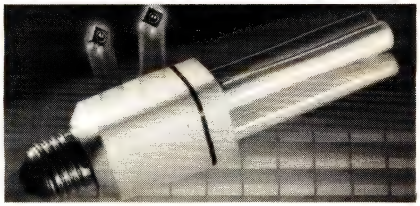
Pricing for the model 513R servoamplifier is $789 in lots of one to nine. Delivery is from stock to four weeks.

Copley Controls Corp., 410 University Ave., Westwood, MA 02090; Jim Woodward, (617) 329-8200. **CIRCLE 769**

■ *DAVID MALINIAK*

SMT POWER MOSFETS ARE HIGHLY EFFICIENT

Two TMOS power MOSFETs in the DPAK surface-mounted package are specified for 500 V (the MTD2N50E) and 250 V (the MTD3N25E), respectively. The units are designed for energy-efficient applications such as compact fluorescent-lamp ballasts and small switching power supplies. Both are designed to withstand high energy in the avalanche and commutation modes. The avalanche-energy capability is specified to eliminate the guesswork in designs involving inductive loads and offer additional safety margins against voltage transients. Pricing is $1.52 for the 500-V part and $1.34 for the 250-V device, both in small quantities. Samples are available from stock. DM



Motorola Inc., Semiconductor Products Div., 5005 E. McDowell Rd., Phoenix, AZ 85008; Larry Baxter, (602) 244-5757. **CIRCLE 770**

SWITCHING REGULATOR MINIMIZES EXTERNALS

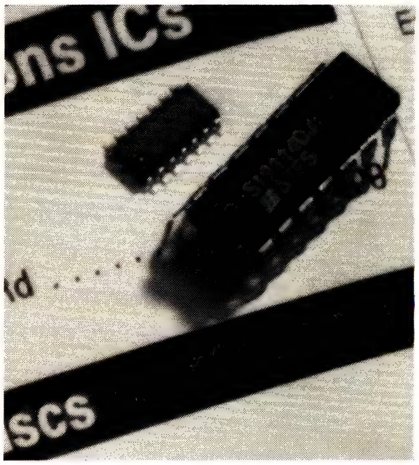
A step-down, inverting dc-dc converter with a 1-A internal switch is available for applications in distributed power, memory backup, portable equipment, and other battery-powered equipment. The LTC1174 converter, which comes in fixed 5-V, fixed 3-V, and adjustable versions, requires only four external components to implement a complete dc-dc converter with 94% efficiency. The unit's input voltage ranges from 4 to 13.5 V, and it draws only 130 µA under no-load conditions. In shutdown, it draws no more than 1 µA. In dropout, the internal p-channel MOSFET switch runs at 100% duty cycle to maximize battery life. Supplied in 8-pin DIP or 8-lead SOIC packages, the LTC1174 costs $3.60 and $3.80, respectively, in lots of 1000. DM

Linear Technology Corp., 1630 McCarthy Blvd., Milpitas, CA 95035-7487; (800) 637-5545.

CIRCLE 771

SWITCHMODE IC BOOSTS FUNCTIONALITY

A switchmode-control IC for communication-network designs operates directly from telephone-line voltages for switching frequencies of 500 kHz and higher. The Si9114 IC is a highly integrated device with features such as soft-start internal start-up and latched shutdown circuitry. It allows either a flyback or forward converter to be implemented at switching frequencies up to 1 MHz. A sync-output pin enables additional power converters to be synchronized to each other or to an external clock. The 14-pin IC comes in both plastic DIP and SOIC packages and costs $1.73 in OEM lots. Samples and production quantities are available now. DM

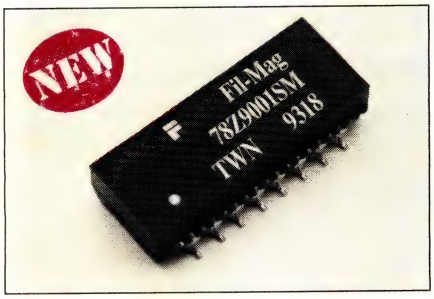


Siliconix, P.O. Box 54951, Santa Clara, CA 95056-0951; (800) 554-5565, ext. 92. **CIRCLE 772**

SMT DC/DC Converter Line Includes Micro-miniatures.

FEE Fil-Mag announces two new families of DC/DC converters. The first is an exact electrical duplication of the 12 standard through-hole offerings, but in a true SMT package. The second is a micro-miniature offering of 4 "basic" products: unregulated 5 to-9 and 12 to -9, available with or without enable. This series is targeted for the pocket LAN and motherboard markets, where space is at a premium. FEE Fil-Mag is the only magnetics component manufacturer with ISO 9001 quality certification. **FEE Fil-Mag, Tel: (619) 569-6577, Fax: (619) 569-6073.**

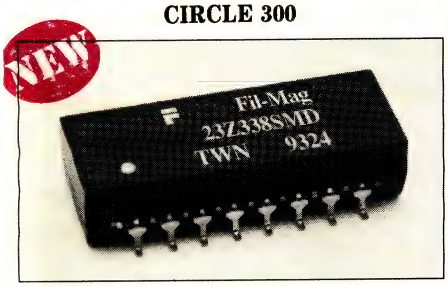
CIRCLE 283



FDDI Module Meets X3T9.5 TP-PMD Standards.

FEE Fil-Mag's new 78Z9001SM and 78Z9003SM provide a complete analog solution between FDDI transceiver and Category 5 UTP cable, per proposed standards set by TP-PMD, ANSI X3T9.5 committee. Each 16-pin SMT module operates with MLT-3 encoded data, where operations over wide bandwidth and fast rise times are critical system requirements. The cross-talk is significantly reduced to improve signal-to-noise ratio. FEE Fil-Mag is the only magnetics component manufacturer with ISO 9001 quality certification. **FEE Fil-Mag, Tel: (619) 569-6577, Fax: (619) 569-6073.**

CIRCLE 300

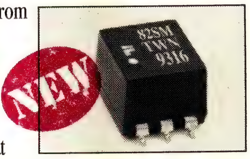


FEE Fil-Mag Debuts MDI Transformers for LXT 914 Repeater IC.

FEE Fil-Mag has announced the introduction of its new MDI isolation transformers, specifically designed for use with Level One's LXT 914 multiport repeater chip. Fully compliant with IEEE 802.3 10Base-T isolation voltage requirements, the cost-effective 16-pin components are available in SMT and through-hole packages. FEE Fil-Mag is the only magnetics component manufacturer with ISO 9001 quality certification. **FEE Fil-Mag, Tel: (619) 569-6577, Fax: (619) 569-6073.**

CIRCLE 301

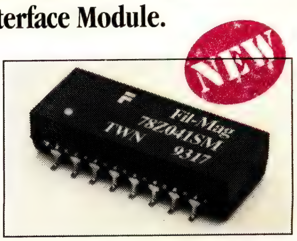
Transformers for LON™WORKS Feature True SMT Design.



A new transformer line from FEE Fil-Mag is designed specifically for use with Echelon™ and Neuron™ chips, available from Motorola and Toshiba, at 1.25 Mbps, in twisted-pair applications. These include local operating network communication for smart, low-cost products for health care, consumer electronics, vehicle control and commercial construction. Part numbers are 66Z1310 (through-hole) and 23Z282SM, which offer the first true surface mount design for this type of transformer. Delivery is stock to four weeks, and prices are from $1 to $2 in OEM amounts. FEE Fil-Mag is the only magnetics component manufacturer with ISO 9001 quality certification. **FEE Fil-Mag, Tel: (619) 569-6577, Fax: (619) 569-6073.**

CIRCLE 302

FEE Fil-Mag Introduces Universal 10Base-T Interface Module.



The new universal 10Base-T filter/magnetic module from FEE Fil-Mag provides physical layer interface between the RJ45 connector and the front-end transceiver. Fully compliant with IEEE 802.3 standards, the module is ideal for PC motherboard, adapter card, Hub and MAU applications, improving system performance via significant reduction in EMI radiation and cross-talk. The new module is designed as a low-profile, fully homogenized 16-pin SMT package. FEE Fil-Mag is the only magnetics component manufacturer with ISO 9001 quality certification. **FEE Fil-Mag, Tel: (619) 569-6577, Fax: (619) 569-6073.**

CIRCLE 303

Need Top-Quality SMT Magnetics for your LAN Applications?
Talk to our competition.
Then talk to us.
FEE Fil-Mag

Take a look at how the other folks design and fabricate their components. Then compare that with our ISO 9001 certified engineering and manufacturing facilities.

If quality is a vital element of your design, we think you'll pick FEE Fil-Mag. Here's why:

Magnetics Quality By Design

• Transfer-molded parts for greater durability, ideal for high-temperature soldering processes • Automated trim, form and insertion into tubes • All leads retinned to ensure optimum joints • Every part optically checked for coplanarity to 2 mils • Stringent ATE part-test procedures • All operations performed tube-to-tube, untouched by hand • Automatic insertion into tape • Guaranteed minimal PPM reject rates • Optimum assembly productivity.

With FEE Fil-Mag components, you build ISO 9001 quality into your products. That's world-class quality that you pass on to your customers — **a promise that none of the other folks can make.**

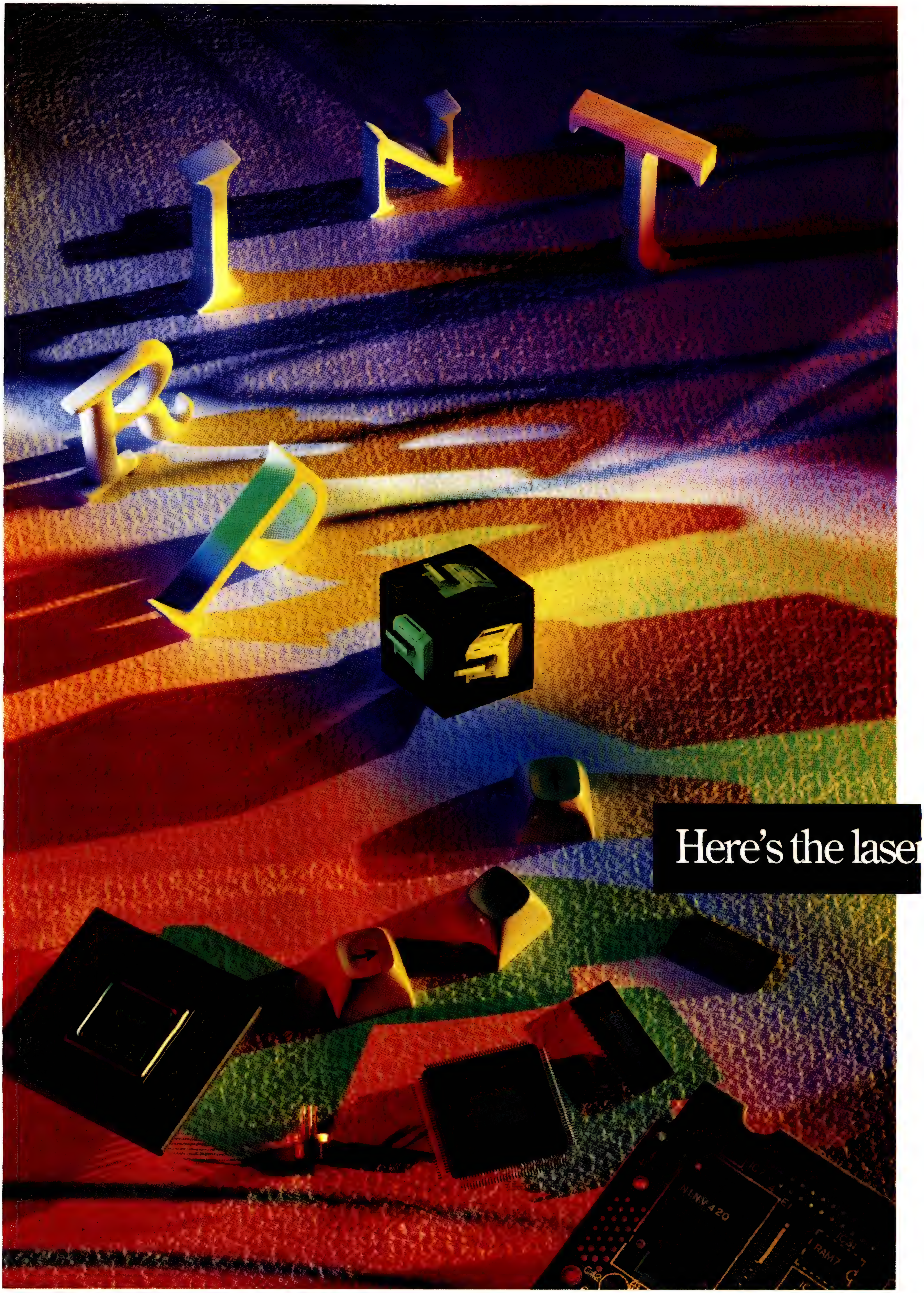
For more information on the finest quality DataComm magnetic components available, **call, write or fax us TODAY** for our new product brochure.

FEE
Fil-Mag

9445 Farnham Street
San Diego, CA 92123
Tel: (619) 569-6577
Fax: (619) 569-6073

CIRCLE 299 SEND LITERATURE **CIRCLE 282 CALL ME. I'M INTERESTED.**

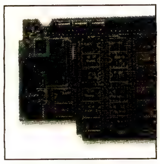
FOR OUTSIDE THE U.S. FAX 619-569-6073


Here's the lase

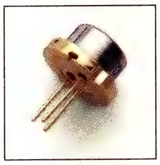
version of Toshiba's system-smart story.

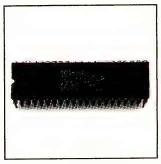
What's the story on Toshiba? System solutions.

It's true. Nobody can add more value to your system more ways than Toshiba. From 32-bit RISC processors and design-defining ASICs to optimally-featured microcontrollers, right down to multi-layer PCBs, we're definitely thinking "big picture" when we look at your system plans.

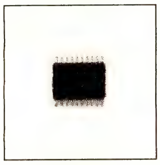

Printed Circuit Board

Pseudo SRAM

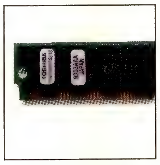

Visible Laser Diode

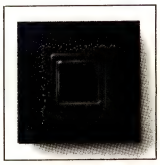

Mask ROM

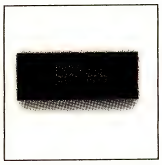
ASIC


Logic

Memory Cards


DRAM Module


RISC Microprocessor


DRAM

Let us prove the point using an up-to-date laser printer as just one example. You'll put our wide selection of DRAM densities and organizations to good use as main memory and soup-up performance using our SRAMs as buffer memory. We've got the MROM you need for code storage. And memory cards for fonts, buffers and custom options.

We can provide the printed circuit board, too, along with a RISC-based CPU and microcontrollers for the print engine motor, glued together with our CMOS logic. Our finely-architected 250ps ASICs with up to 500,000 usable gates, provide a higher level of functional integration for essential market differentiation. Then our visible laser diodes and photo interrupters can make light of it all.

In an era of ever closer partnerships, our broad, broad line of semiconductors and ICs and our finely-honed system sensibilities give us a competitive advantage. More importantly, they give *you* a competitive advantage. By helping you keep a lid on costs and get to market sooner. And when success arrives, Toshiba's legendary manufacturing prowess assures you uninterrupted supply.

Of course, your system's quality is only as good as the sum of its parts. So we take great measures to assure the highest quality components on the market today. We're proud of our ISO 9000 certification in Japan and expect certification in the U.S. by year end. And we top it all off with an unrivaled customer story.

End of story? No, that's just the beginning. Call us today for all the ways we can make your next design a little more elegant, a little more effective and a lot more competitive. 1-800-879-4963.

In Touch with Tomorrow
TOSHIBA
TOSHIBA AMERICA ELECTRONIC COMPONENTS, INC.

©1993 Toshiba America Electronic Components, Inc.

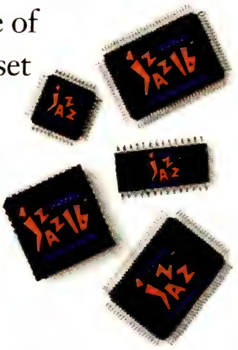
CIRCLE 228 PLEASE CALL ME
CIRCLE 229 SEND MORE INFORMATION

HDQ-92-073

IN EVERY SOUND, YOU'LL FIND THE ROOTS OF JAZZ.

Introducing JAZZ™ and JAZZ16.™ The newest family of sound chips from the leader in high performance multimedia solutions. Media Vision.

Just listen to their performance. JAZZ sets the standard for PC audio with the ultimate in application compatibility* and ease of use. The JAZZ16 chipset adds genuine 16-bit CD-quality audio with integrated hardware compression for the professional audio solution. All of this makes JAZZ chips the obvious selection for your next sound design. So give us a call or send us a fax for more information: 1-800-348-7116 ext. 4455, fax: 1-510-770-9592. It's time to JAZZ up your designs.



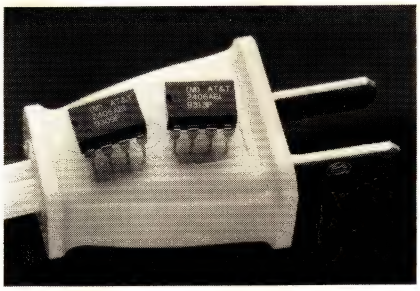
MEDIA VISION

* JAZZ is compatible with Sound Blaster™, Sound Blaster Pro™, Windows™ 3.1 and MPC I. Jazz16 adds MPC II compatibility. © 1993 Media Vision, Inc., 3185 Laurelview Court, Fremont, CA 94538. Phone: 1-800-845-5870. Media Vision is a trademark of Media Vision, Inc. All other trademarks and registered trademarks are the property of their respective companies.

CIRCLE 152 FOR U.S. RESPONSE

CIRCLE 153 FOR RESPONSE OUTSIDE THE U.S.

ICs ARE AN ANSWER TO OFF-LINE POWER



A pair of ICs eliminates the need for discrete supplies to power the microprocessors in many consumer-electronics items. The ATT2406 off-line power-supply IC converters ac-line power to a regulated dc voltage while featuring an input-voltage rating of 600 V. It also offers an optional range of dc output from 5 to 70 V and a guaranteed output current of 100 mA. The ATT2405 IC is rated for 500-V input and can be configured to provide from 5 to 24 V of dc output at a guaranteed 50 mA. Both ICs integrate the functions of a transformer, rectifier bridge, and voltage regulator into a single chip, which simplifies the designer's job. Both come in 8-pin plastic DIPs. The ATT2405 goes for $1.66 in lots of 1000, and the ATT2406 costs $1.91 in similar quantities. Delivery is from stock. DM

AT&T Microelectronics, Dept. AL500404200, 555 Union Blvd., Allentown, PA 18103; (800) 372-2447, ext. 882. CIRCLE 773

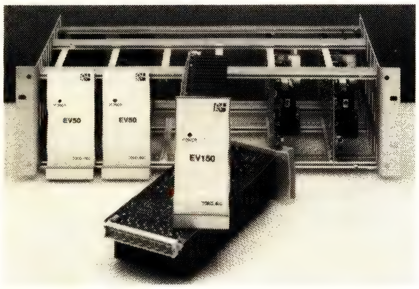
3.3-V CONVERTERS BOAST WIDE INPUTS

The 1600 and 700 Series dc-dc converters provide a tightly regulated 3.3 V dc output from wide 2:1 input-voltage ranges of 9 to 18, 18 to 36, or 36 to 72 V dc. Four models offer features such as 500-V dc input-to-output isolation, efficiencies as high as 78%, continuous short-circuit protection, and low output ripple and noise. Output-voltage accuracy is ±1%. Pricing is as low as $52.50 in lots of 100 with delivery from stock to four weeks. DM

Conversion Devices Inc., 15 Jonathan Dr., Brockton, MA 02401; (508) 559-0880. CIRCLE 798

SWITCHING SUPPLIES FIT INTO EURORACKS

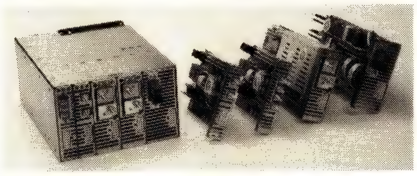
A line of switching power supplies now includes a series designed specifically for Eurocard and VMEbus systems. The EV Series provides 3U-Eurorack compatibility and uses standard DIN 41612 type H15 connectors. Universal input of 90 to 260 V ac and a dual output of +5 and +12 V is offered on both models EV50 (50 W) and EV150 (150 W). Safety features include current limiting and overvoltage protection, remote sensing of output voltage, and power-fail-monitor circuitry. The units also offer redundant power source and hot-swap capabilities. It incorporates MOSFET switching circuitry, a low component count, and a 20% component derating to minimize heat. The series meets all UL, CSA, and TUV safety standards as well as FCC and VDE/FTE EMI regulations. Call for pricing. DM



Toko America Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056-6023; (708) 297-0070. CIRCLE 774

MODULAR SUPPLIES REDUCE DESIGN DELAYS

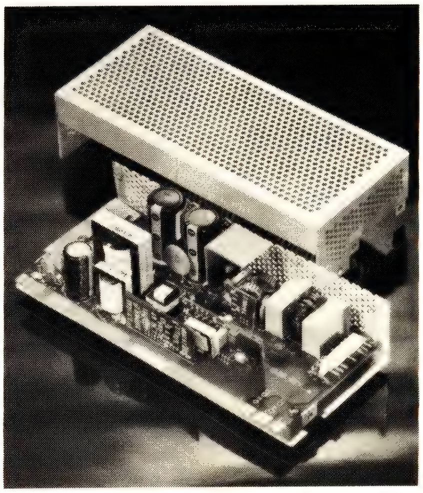
Off-the-shelf output modules that permit custom configuration without engineering delays are the centerpiece of the MPS Series of 1200-W building-block power supplies. Configuring the supplies is simply a matter of plugging the appropriate standard output modules into a 5-by-8-by-11-in. chassis. Available output modules include models supplying 2, 3.3, 5, 12, 15, 24, 28, and 48 V with power ratings ranging from 80 to 1200 W each. The chassis includes the input circuit, which incorporates active, low-frequency power-factor correction to meet IEC 555-2 standards. All MPS configurations meet applicable worldwide safety standards as well as VDE and FCC conducted-EMI standards with input filtering. As a pricing example, the model MPSA-2G3D3D, which includes one 500-W module, two 240-W modules, and a Class A EMI filter, goes for $890 in OEM quantities. Small quantities are delivered from stock. DM



Computer Products Inc., 7 Elkins St., South Boston, MA 02127; Janice Williams, (617) 464-6656. CIRCLE 775

250-W SWITCHER DISTRIBUTES DC POWER

A 250-W, 56-V ac-to-dc switching power supply is designed for distributed applications requiring battery backup. The model 10-0168 supply is a thermally protected, parallelable unit that allows scaling up for upgrades. Features include N+1 redundancy, surface-mount construction, high density, a full enclosure, hot pluggability, and a high MTBF rating. Units are also available in a 48-V configuration. Pricing ranges from $758 in single quantities to $225 in lots of 1000 or more. Call for delivery information. DM



MicroEnergy Inc., 745 State Rd. 434, Longwood, FL 32750-4909; Gayle Bojerski, (407) 831-2000. CIRCLE 776

CATALOG/LITERATURE REVIEW

AGEMA's IMAGING SYSTEM

Full-color brochure and a 10-minute videotape describe and demonstrate features and applications for AGEMA Infrared Systems' high definition Thermovision(r)900 series, for scientists or engineers for whom reliable, real time thermal measurement and analysis can provide invaluable product or process insights.

CIRCLE 361

AGEMA INFRARED SYSTEMS INC.

BROADBAND POWER AMPLIFIERS

This guide from Amplifier Research, Souderton, Pa., offers hints on selecting rf amplifiers in power range from 1 to 100,000 watts, frequency 10 khz to 1 GHz. Linearity, instant bandwidth, immunity to load mismatch are included in discussion.

CIRCLE 362

AMPLIFIER RESEARCH

NEW NEMA ENCLOSURES BY BUD

Bud Introduces a new line of Nema4 & 4x enclosures priced at non-nema prices. Sealed aluminum enclosures, available in 8 sizes, In-line Modular / Mounting enclosures in 28 versions. Also, 2 new lines of plastic enclosures meet nema 4 / 4x specs.

CIRCLE 363

BUD INDUSTRIES INC.

SURFACE MOUNT SWITCHES

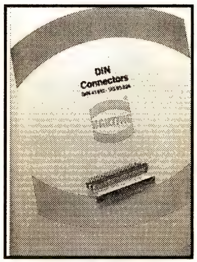
Catalog features the industry's broadest line of surface mount switches compatible with today's demanding cleaning methods. The product line includes a wide variety of minature toggle, pushbutton, slide & dip switch models.

CIRCLE 364

C&K COMPONENTS, INC.

DIN CONNECTORS

Colorful brochure provides detailed information and specifications on HARTING's Gds A standard DIN 41612 printed circuit board connectors. ISO 9001 certified. Mounted & fixed to the PC board in single procedure. Wide range with many styles of shell housings.

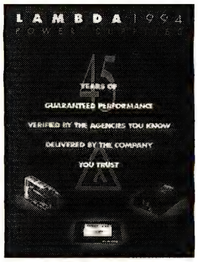


CIRCLE 365

HARTING ELEKTRONIK, INC.

POWER SUPPLIES

A new 168 page full-line catalog is available free on request from Lambda Electronics Inc., Melville, N.Y. It contains detailed information and prices on over 1000 standard power supplies, systems and accessories including 200 new products.

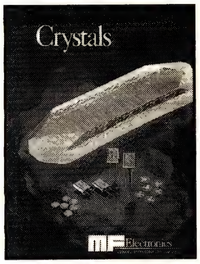


CIRCLE 366

LAMBDA ELECTRONICS INC.

CUSTOM FREQUENCY CRYSTALS

MF Electronics offers a new crystals brochure. Included is general crystal design information and quartz microprocessor and special crystal info. Detailed definitions and directions for selecting custom crystals are listed.



CIRCLE 367

MF ELECTRONICS CORP.

386SL EMBEDDED PC (R)

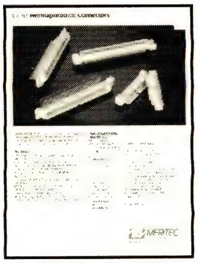
Megatel Computer Corp. Weston, Ont. has released their 386sl microcomputer for the embedded PC market. The PC/II+ incorporates on-board super VGA, Ethernet, 16Mb Dram, SCSI, Floppy and Serial Controllers. Complete product catalogues available.

CIRCLE 368

MEGATEL COMPUTER CORP.

.050 x .100 CP50 CONNECTOR

Meritec's 100 position Hermaphroditic Connectors on .050 X .100 spacing eliminate the need for traditional mother boards in VME BUS applications. The high density design provides uniform spacing between adjacent boards.

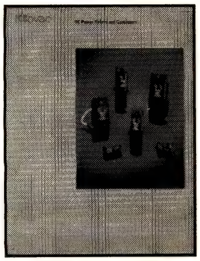


CIRCLE 369

MERITEC

DC RELAYS & CONTACTORS

Whether your power control applications call for 48 Vdc or 1000 Vdc, isolation or power switching, this informative catalog will help you find the best solution for your requirements.



CIRCLE 370

KILOVAC CORPORATION

TRANSFORMERS, DC-DC CONVERTERS

Pico 136 page catalog features new 100 watt dual output DC-DC Converters Series plus other standard models up to 1000 VDC output voltages. Also included are thousands of surface mount transformers & inductors and an AC-DA Power Supply Section.

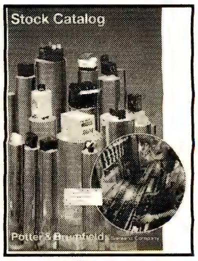
PICO
SURFACE MOUNT / PLUG-IN TRANSFORMERS & INDUCTORS
DC-DC CONVERTERS
AC-DC POWER SUPPLIES
HIGH POWER DC-DC CONVERTERS
PICO Electronics, Inc.

CIRCLE 371

PICO ELECTRONICS INC.

RELAYS & CIRCUIT BREAKERS

Catalog details a broad line of relays and circuit breakers for use in appliance, HVAC, automotive, industrial control, communication and other applications. Offers various contact, input, package and mounting options.

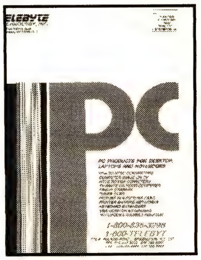


POTTER & BRUMFIELD

CIRCLE 372

PC VIDEO BROCHURE

Telebyte Technology, Inc. just announced the availability of its new PC Brochure, containing information on the Company's video products, VGA to NTSC converters, NTSC to VGA converters, frame grabbers, printer sharing products to support multiple PC's and ethernet adapters for coupling notebook PC's on existing ethernet based local area networks.

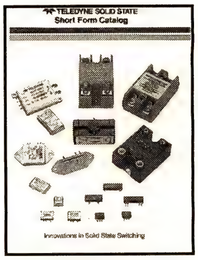


CIRCLE 373

TELEBYTE TECHNOLOGY, INC.

SOLID STATE RELAYS

A comprehensive solid state relay selection guide featuring Teledyne's latest state of the art Commercial / Industrial and Military SSR's for Telecom, Automotive, Medical, Process Control. Also includes Computer I/O Modules.

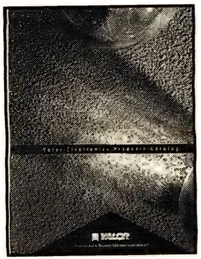


CIRCLE 374

TELEDYNE SOLID STATE

INTEGRATED MAGNETICS

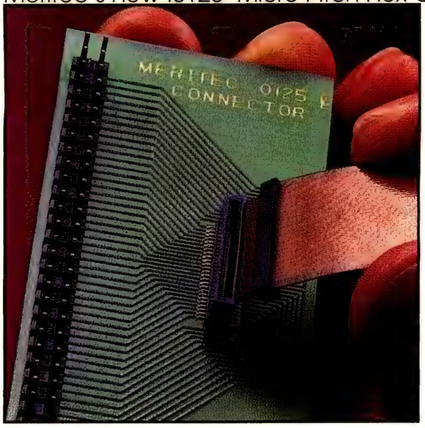
The leading supplier of magnetic-based interface components for networking applications, Valor provides cost effective, integraded solutions for design engineers. Product details are provided in our comprehensive catalog.



CIRCLE 375

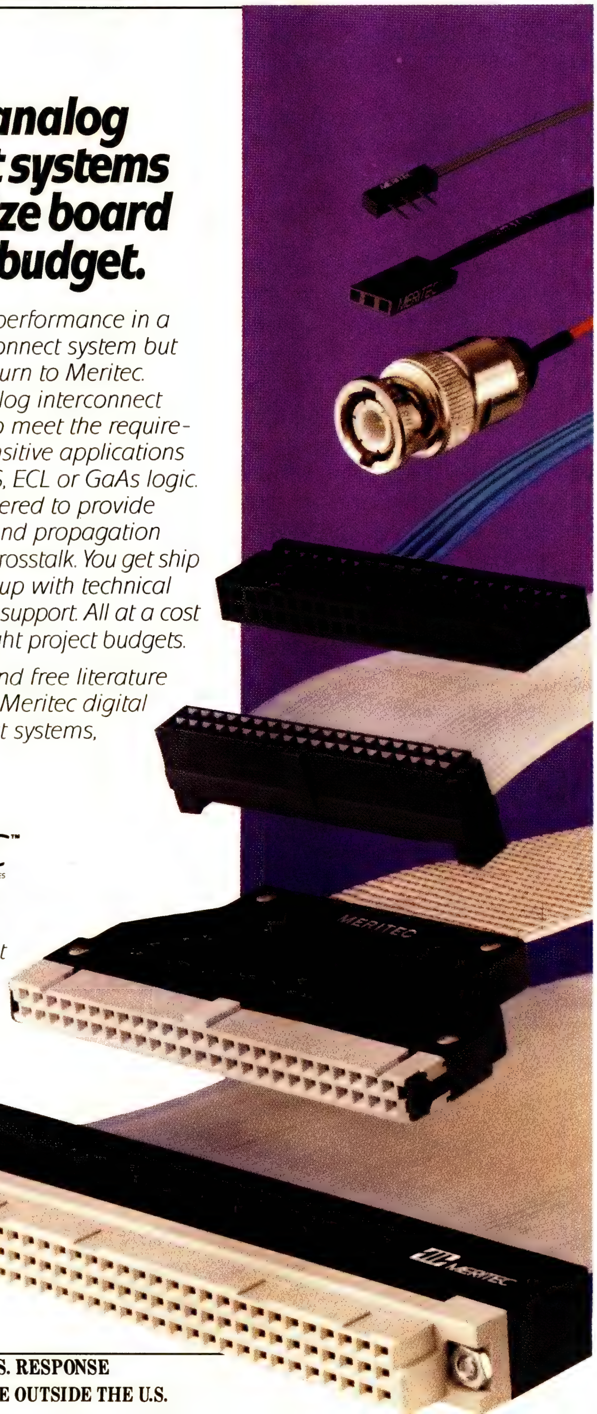
VALOR ELECTRONICS, INC.

.0125" Flex Circuit Assemblies



Meritec's new .0125" Micro Pitch Flex Circuit Assemblies are manufactured using a patented insert molding process which allows extremely tight spacing on the contacts without sacrificing reliability or normal forces. Because the contacts are insert molded instead of pushed into plastic, tolerance stack up problems are eliminated. The high density terminations on the assemblies allow continuous process straight configuration flex circuit cable to be used, which substantially lowers cost and turnaround time, since the cutting dies and processes normally associated with flex circuit cable are eliminated.

Circle No.322.



Digital and analog interconnect systems that maximize board density and budget.

If you need speed and performance in a digital or analog interconnect system but have a limited budget, turn to Meritec. Meritec digital and analog interconnect systems are designed to meet the requirements of electrically sensitive applications using high speed CMOS, ECL or GaAs logic. Our systems are engineered to provide controlled impedance and propagation delay while minimizing crosstalk. You get ship to stock quality, backed up with technical service and applications support. All at a cost that's well in line with tight project budgets.

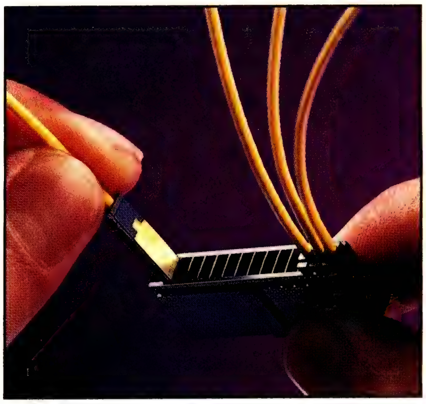
For more information and free literature on the complete line of Meritec digital and analog interconnect systems, call 216-354-3148.

MERITEC™
A DIVISION OF ASSOCIATED ENTERPRISES
Where quality assures performance

1359 West Jackson Street
P.O. Box 8003
Painesville, Ohio 44077
Phone: 216-354-3148
FAX: 216-354-0509

CIRCLE 318 FOR U.S. RESPONSE
CIRCLE 319 FOR RESPONSE OUTSIDE THE U.S.

Controlled Impedanc Ground Plane Interconnects (GPITM)



Meritec's new Ground Plane Interconnects are engineered to match impedance and propagation rate while minimizing crosstalk.The assemblies are impedance matched from the board through the assembly. As a result, signal-to-signal crosstalk is minimized. The assemblies are designed for CMOS, ECL or GaAs logic. A spring latch connects the termination to the housing or to Meritec's Single Signal Carrier System (SSCTM), which allows grouped interfacing with single, dual or triple row headers. Precision, high strength molded terminations are highly reliable in critical applications. Circle No. 323

Low Profile Impedance Matched PCB Solderable Interconnects

Meritec's low profile, impedance matched PCB Solderable Interconnects solder directly to the PCB for a permanent connection. Pinlengths of .110" and .160" are available for different board thicknesses. The connectors feature precision, high strength molded terminations for reliability in critical applications.

Available in 1x2 and 1x3configurations, the connectors are side-to-side stackable and feature heights as low as.150" from the PC Board, making them ideal for dense package applications. Meritec PCB Solderable Interconnects may be terminated to a variety of different subminiature cable types.

Circle No.324

CALL FOR PAPERS

The Portable By Design Conference and Exposition

Sponsored by Electronic Design Magazine

Electronic Design is soliciting technical papers to be presented at the Portable By Design Conference February14-17, 1994 in the Santa Clara Convention Center, Santa Clara, Calif.

Engineers experienced in designing portable electronic systems of all types are invited to share their expertise. The range of eligible design applications includes computing, communications, data-entry, navigation and instrumentation--in either vertical and horizontal markets.

Papers should emphasize problem solving and provide insights into specifying and designing portable systems.

General topics to be covered include: Microprocessors and microcontrollers;
Power sources and circuits; Power management techniques; Batteries; Connectivity (e.g. docking, public wired network and all wireless); Software (e.g. operating systems including proprietary OS and application development); Peripherals (e.g. PCMCIA, GPS, storage); Displays; Input devices; and, System design considerations (e.g. accelerated product development, testing, size, ergonomics and ruggedness)

To participate, respond to this call for papers by sending a one-paragraph abstract of a paper you would like to present. Papers should be oriented toward solving specific design problems.

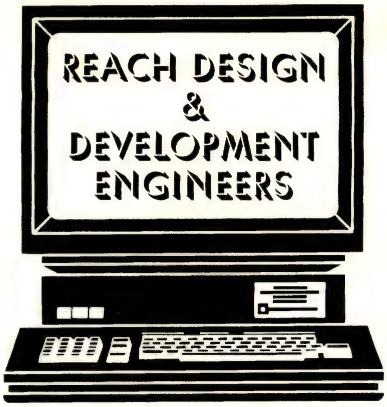
Abstracts should be sent to: *Program Chair, Portable By Design* Conference, c/o Electronic Design Magazine, P.O. Box 821, Hasbrouck Heights, NJ 07604. Or, send by fax to (201) 393-0204.

Deadlines:

Abstracts: October 15, 1993

Full Papers: January 15, 1994

ATTENTION MARKETERS!



ELECTRONIC DESIGN
subscribers are highly educated engineers and managers in the electronics original equipment market.

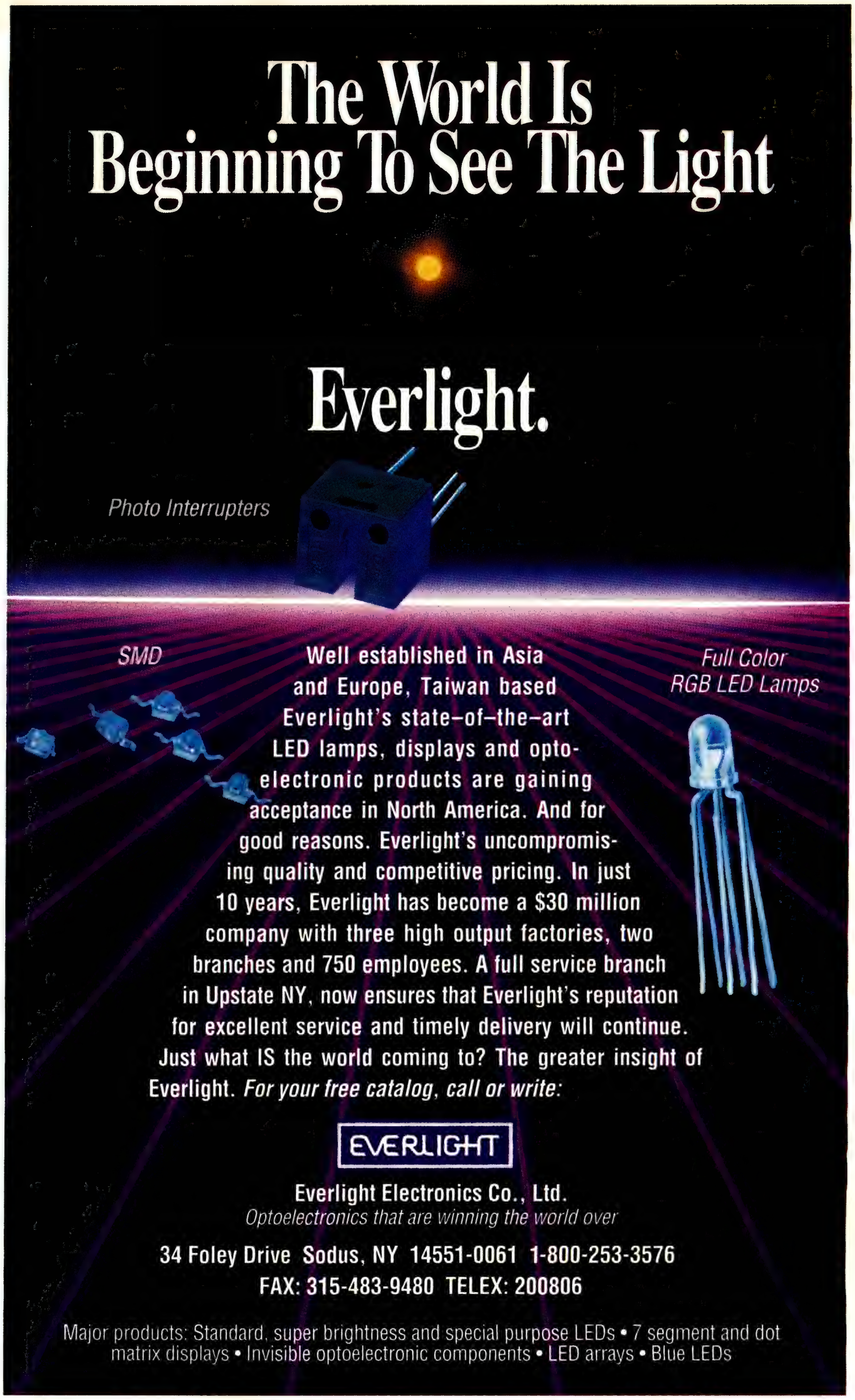
Select by job function, type of industry, purchasing influence, employment size, and geography.

●

Guaranteed
99% Deliverable
100% BPA Audited.

Call your Advertising Representative, or call **(216) 696-7000**, and ask for the List Department. Request your FREE Penton Lists Catalog!

Penton Lists


The World Is Beginning To See The Light

Everlight.

Photo Interrupters
SMD
Full Color RGB LED Lamps

Well established in Asia and Europe, Taiwan based Everlight's state–of–the–art LED lamps, displays and opto-electronic products are gaining acceptance in North America. And for good reasons. Everlight's uncompromising quality and competitive pricing. In just 10 years, Everlight has become a $30 million company with three high output factories, two branches and 750 employees. A full service branch in Upstate NY, now ensures that Everlight's reputation for excellent service and timely delivery will continue. Just what IS the world coming to? The greater insight of Everlight. *For your free catalog, call or write:*

EVERLIGHT

Everlight Electronics Co., Ltd.
Optoelectronics that are winning the world over
34 Foley Drive Sodus, NY 14551-0061 1-800-253-3576
FAX: 315-483-9480 TELEX: 200806

Major products: Standard, super brightness and special purpose LEDs • 7 segment and dot matrix displays • Invisible optoelectronic components • LED arrays • Blue LEDs

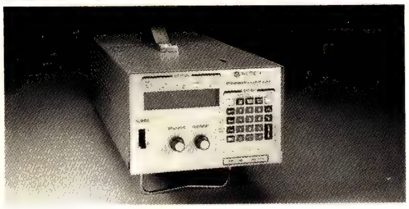
CIRCLE 340 FOR U.S. RESPONSE

CIRCLE 341 FOR RESPONSE OUTSIDE THE U.S.

DIGITAL SUPPLY OFFERS CONTROL FLEXIBILITY

A variety of control options lends flexibility to a line of 360-W bench-top power supplies. The MBT Series includes a serial, two-wire communication port that complies with IEEE-1118 for long-distance (300 meters) control. And an optional built-in single-board computer (SBC) gives users their choice of IEEE-488-2 short-range parallel communication or RS-232C control.

The supplies are available in eight output combinations, from the MBT 6-32MG (zero to 6 V at 32 A) to the MBT 150-2.4MG (zero to 150 GV at 2.4 A). As a stand-alone supply, the series offers direct-entry keyboard control of voltage, current, and protective settings with slew up-down buttons for convenient incrementing. A pair of control knobs drive optical encoders for the familiar feel of rotary controls.



A two-line, 16-character panel display facilitates the user interface. It displays menu selections, control settings, and output readings. All of these can be read back on any of the supplies' external communication buses.

Models with the internal SBC contain an IEEE-488-2 port, support the SCPI and CIIL languages, and can retransmit instructions received over the IEEE-488 bus to other power supplies on the long-range IEEE-1118 bus. SBC-equipped supplies can control up to 27 other units from a single GPIB address.

Pricing for the MBT Series supplies is $2499 with the SBC and $1889 without. Delivery is from stock.

***Kepco Inc.**, 131-38 Sanford Ave., Flushing, NY 11352; (718) 461-7000.* **CIRCLE 777**

■ *DAVID MALINIAK*

BATTERY CHARGER OFFERS DUAL MODES

Designed for permanent connection to sealed lead-acid batteries in portable equipment or UPS systems, the series BCA-5600 open-frame chargers run in constant-current mode to recharge batteries at the highest possible rate, and then switch to constant-voltage mode for charge maintenance. The series includes a 13.8-/15-V, 2-A model for 12-V batteries and a 6.9-/7.5-V, 3.5-A unit for 6-V batteries. Both are protected from short circuits, battery-connection reversals, and overheating. They also offer temperature-compensated outputs. Models are available with 115- or 230-V inputs and cost $130. Call for delivery. DM

Ibex Manufacturing Inc., Route 47, Francestown, NH 03043; Richard Wharton, (603) 547-6209.

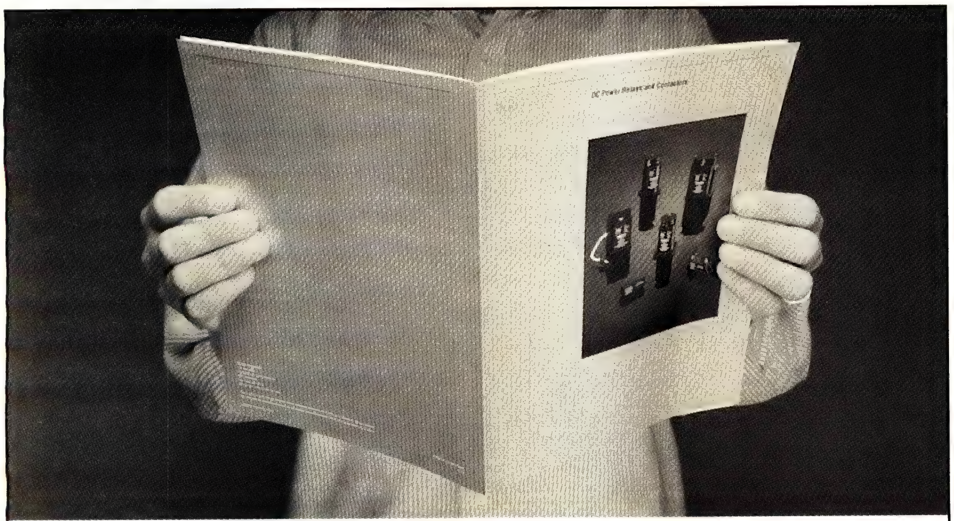
CIRCLE 778

SMT-READY MOSFETS SPELL DENSE CONVERTERS

The D^{2}PAK surface-mount package now houses a pair of TMOS power MOSFETs for space-critical applications in dc-dc converters. The MTB20N20E and MTB33N10E MOSFETs are designed to withstand high energy in the avalanche and commutation modes. Their respective $R_{DS(on)}$ ratings are 0.16 and 0.06 Ω, and their voltage and current ratings are 200 V/20 A and 100 V/33 A. The D^{2}PAK eliminates the tab shearing and lead forming required to prepare TO-220 power packages for surface mounting. Pricing for the MOSFETs in the D^{2}PAK is $6.66 with samples and small production quantities available from stock. DM

Motorola Inc., MD Z301, 5005 E. McDowell Rd., Phoenix, AZ 85008; Larry Baxter, (602) 244-5757.

CIRCLE 779



If your products require reliable DC power switching of up to 1000 Vdc...

The solution's in your hands.

Whether your power-control applications call for 48 Vdc or 1000 Vdc isolation or power switching, Kilovac has the solution.

For over two decades, Kilovac has been designing and manufacturing a broad line of high voltage vacuum and gas-filled relays for industrial and commercial applications.

Write or call Kilovac for complete product literature or to discuss your specific high voltage applications.

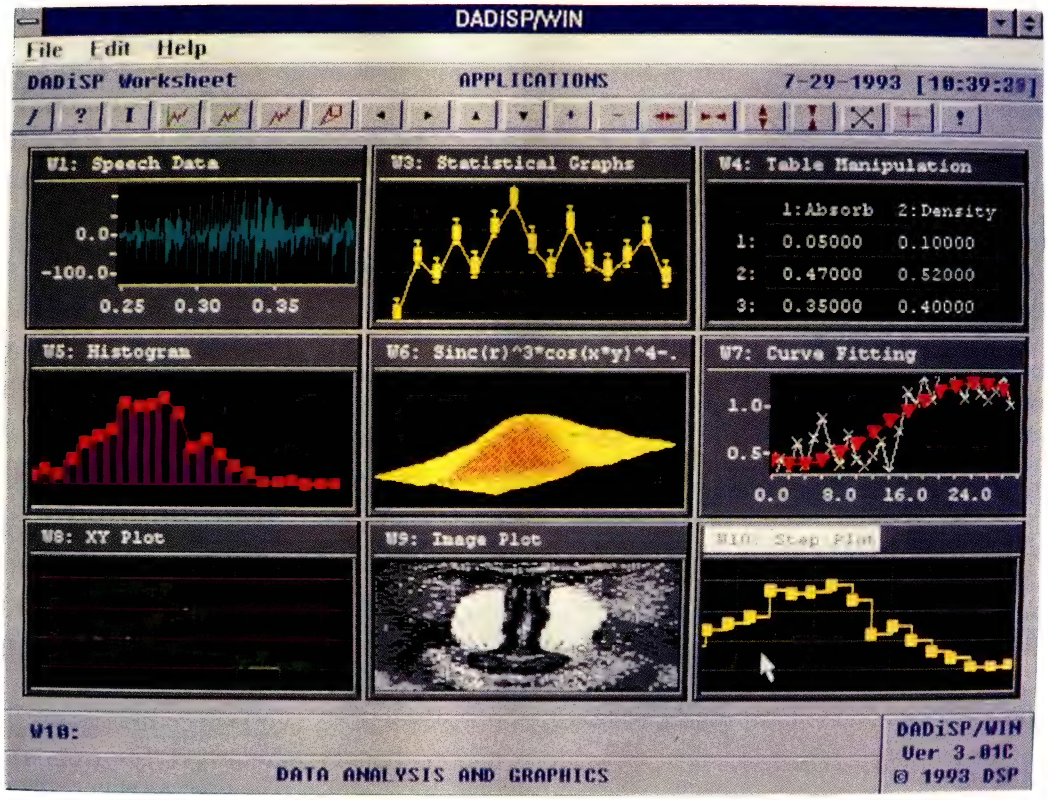
APPLICATION HOTLINE: 800/253-4560

Kilovac®

The Experts in High Voltage Relays and DC Power Switching Devices.
P.O. Box 4422 • Santa Barbara, CA 93140
805/684-4560 • Fax: 805/684-9679

CIRCLE 355 FOR U.S. RESPONSE
CIRCLE 356 FOR RESPONSE OUTSIDE THE U.S.

For Engineers who Excel.



	1:Absorb	2:Density
1:	0.05000	0.10000
2:	0.47000	0.52000
3:	0.35000	0.40000

DADiSP combines more than 500 functions for displaying and analyzing your type of data with the power and flexibility of a spreadsheet. Construct sophisticated data analysis in windows, in seconds, at a new level of price/performance.

Now Data Analysis is as easy as pushing a button.

No more fumbling with business software. And no need to learn a new programming language. Just *point and click* and DADiSP displays your results *immediately*. Load a new data series, matrix, signal or image, and all cells update automatically.

Extended features tackle your toughest Data Analysis problems.

With DADiSP, you can build an endless number of new worksheets and even your own custom menus. And DADiSP/DDE let's you run external software—IEEE 488 drivers, data acquisition software, *even your own analysis programs*.

Call today: 1-800-777-5151

for your Free DADiSP Trial Kit. DADiSP is available for SUN, HP, IBM, NeXT, DEC, Concurrent, and Silicon Graphics work stations, and of course, IBM PC compatibles.

DSP
Development
Corporation

One Kendall Square Cambridge, MA 02139
Phone 617-577-1133, FAX 617-577-8211

DADiSP/Windows

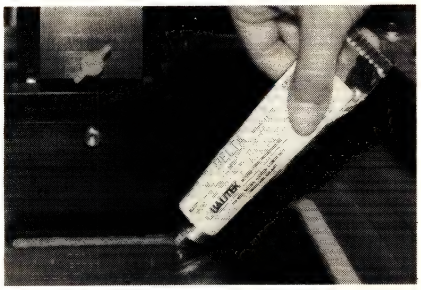
Australia & New Zealand-Interworld Electronics, (03) 563-5011; **Austria**-Norma Goerz Instruments GmbH, (02236) 6910; **Belgium**-Electronique-Mesures, **Brazil**-SDC, (011) 564-6024; (02) 384-7309; **Denmark**-Engberg, (042) 25-1777; **Finland**-Mespek (9) 0-351-1800; **France**-SM2i, (01) 34-89-78-78; **Germany**-I.H.L. (0631) 99226; Ingenieurbüro, (069) 9765-000; PDV Systeme (0521) 80761; **Hungary**-Selectrade Computer, (01) 163-2905; **India**-Dynalog Microsystems, (022) 517-0514; **Israel**-Racom, (03) 491922; **Italy**-BPS Computers, (02) 660-14267; **Japan**-Astrodesign, (044) 751-1011; **Korea**-Echo Microsystems, (02) 704-5378; **Netherlands**-Peekel Instruments (010) 4152722; **Portugal & Spain**-Novatronic, (04) 452-0811; **Singapore**-Neurotech, 336-4767; **Sweden**-SYSTEC, (013) 11-01-40; **Switzerland**-Urech & Harr, (061) 61-13-25; **Taiwan**-Howching (02) 505-0525; **U.K.**-Adept Scientific, (0462) 480055

CIRCLE 338 FOR U.S. RESPONSE

CIRCLE 339 FOR RESPONSE OUTSIDE THE U.S.

NO-CLEAN SOLDER SUITS FINE-PITCH SMT

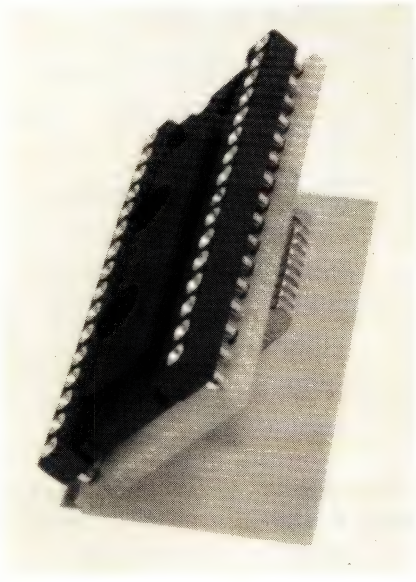
A no-clean solder paste features a formulation that exhibits excellent wetting and fluxing activities. The 600 Series pastes are available in several alloy compositions, including SN63, SN62, and SN60. All alloys are made to exceed QQ-S-571 and ASTM B32 specifications. Mesh sizes from fine pitch to standard are offered, as are pastes for stenciling, syringe dispensing, and screening. Call for pricing and delivery. DM



Qualitek International Inc., 315 Fairbank St., Addison, IL 60101; Debbie Liguori, (708) 628-8083. **CIRCLE 780**

SOCKET CONVERTS DIPS TO PLCCS

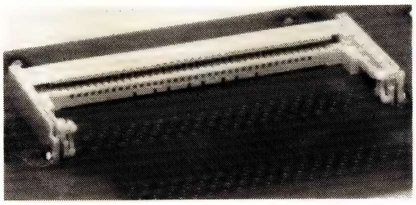
Economic use of DIP parts in PLCC sockets is made possible by the 32D6/PL-V DIP-to-PLCC Socon socket converter. The socket provides a convenient solution for small-to-medium production runs until PLCC parts become available or pc boards are redesigned. The socket has the footprint of the DIP socket and adds only 200 mils to the assembly's total height. It's designed for chip-replacement applications where the number of insertions is relatively low and only a DIP package is inserted into its socket. Pricing is $31 in lots of 100. Delivery is from stock to 15 days. DM



EDI Corp., P.O. Box 366, Patterson, CA 95363; Milos Krejcik, (209) 892-3270. **CIRCLE 781**

DOUBLE-DENSITY SOCKETS SEAT 72-PIN SIMMS

Double-density socket connectors are available to house 72-position, small-outline SIMMs. By offering 0.025-in. lead-termination spacing as opposed to 0.050-in. spacing, the SX1 Series sockets enable the module board to achieve higher density while reducing it to half the size of existing 72-position boards. The SIMM itself actually increases the memory capacity of the module. The right-angle connector has a profile of less than 6 mm when the module board is locked in. Pricing is $3.75 in lots of 1000. Small quantities are delivered from stock. DM



Hirose Electric (U.S.A.) Inc., 2688 Westhills Ct., Simi Valley, CA 93065; (805) 522-7958. **CIRCLE 782**

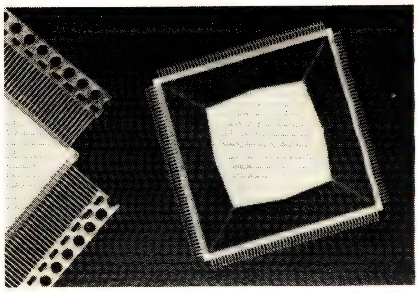
SUBRACK ACCESSORIES PROTECT EURO CARDS

A series of perforated shields (flat and grounding) and rear protective hoods protect and shield Euro subracks and cards. All three are fabricated of 0.063-in.-thick aluminum and can be assembled to the card rack for production use. The flat perforated shields (No. 900) require no assembly hardware and slide easily into guide-rail grooves. The grounding shields (No. 920) are fastened directly to the side plates to provide positive grounding. The rear protective hood (No. 940) offers mechanical protection on the wiring side of the subrack and covers the 3U subrack area. Multiple hoods will cover 6U, 9U, and 12U sizes. Call for pricing and delivery. DM

Electro-Space Fabricators Inc., 300 W. High St., Topton, PA 19562; Bob Flynn, (215) 682-7181. **CIRCLE 783**

LEAD-FRAME TECHNIQUE CUTS PRODUCTION COSTS

Automated and economical attachment of fine-pitch, solder-laden leads to substrates is provided by the continuous-strip, solder-laded lead frame process from Die-Tech Inc. The process eliminates much of the design, tooling, and production costs associated with using custom quad lead frames for EIAJ and Jedec-outline packages such as ceramic quad flat packs. Savings are extended to the most popular lead frame sizes of 0.635 mm (0.25 in.), 0.5 mm, and 0.4 mm. The standard lead-assembly and trim/form system produces surface-mounted devices with body sizes from 20 through 40 mm. Lead frames are fed from a continuous reel by one of the company's lead-attach machines, such as the automatic Model 7000. The technology eliminates the need to tool a custom lead frame for each different combination of package size and lead pitch and is well-suited for high-volume, low-volume, or prototype production environments. Overall unit package costs can be reduced by as much as 85%. Call for pricing. DM



Die-Tech Inc., 295 Sipe Rd., York Haven, PA 17370; (717) 938-6771. **CIRCLE 784**

IN 1993, WHAT WILL BE THE ONLY INTERNATIONAL EXHIBITION FOR ELECTRONIC COMPONENTS IN EUROPE ?

IT IS COMPONIC

From 15 to 19 November 1993 at the Paris-Nord Exhibition Centre

The 1993 COMPONIC, the International Electronic Components Exhibition will have a new look. A major event in the industry calendar, COMPONIC is an absolute must for the entire electronic component field.

A truly international exhibition

COMPONIC 1993, new horizons !
COMPONIC is endorsed by the leading **European electronic component manufacturers** who will be exhibiting alongside major international groups such as **IBM, MOTOROLA, SAMSUNG, ITT...**
An upbeat exhibition in a general climate of economic recovery, the electronic components market is thriving once again.

7 main sections reflecting an expanded range of products

- Semi-conductors, including a special ASIC's centre
- Passive components
- Electro-optical components
- Testing equipment
- Measuring instruments
- Application specific circuits
- Peripheral components

COMPONIC 93 Conferences

Dedicated to immediatly applicable solutions for a broad-based audience of end-users of electronic components, the programme includes:

- Fuzzy logic
- Quality
- The chip card
- Electromagnetic compatibility
- ASIC's
- Digital Signal Processing (DSP)

GIP RCS B384 210 365

BLENHEIM INDUSTRIES

Reply coupon to be returned to : COMPONIC / PROMOSALONS
2300 Clarendon blvd, Suite 310 ARLINGTON VA 22201
Tel. : 703-522 50 00 - Fax : 703-522 50 05

Please send me :
☐ A reduced rate invitation card (80 FF instead of 150 FF)
☐ The conference programme
☐ The Exhibition Catalogue (100 FF carriage free)*
Name .... Forename ....
Company ....
Address ....
.... Tel .... Fax ....

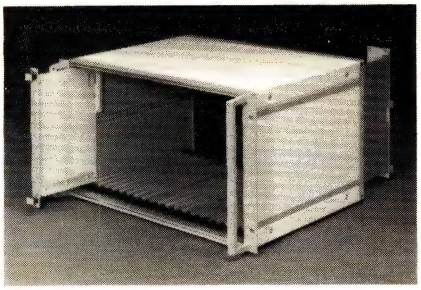
*** Cheque made payable to Componic/Blenheim Industries to be enclosed with your reply coupon**

ED

CIRCLE 330 FOR U.S. RESPONSE **CIRCLE 331 FOR RESPONSE OUTSIDE THE U.S.**

EMC-SHIELDED CASES MOUNT FRONT OR REAR

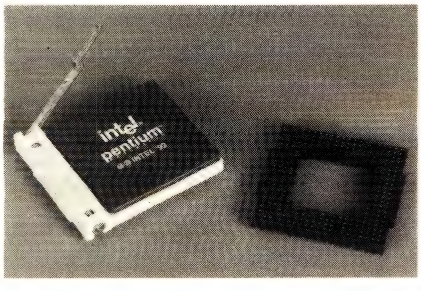
Electronic equipment can be mounted from the front or rear of the Ratiopac Dual line of shielded system cases. The units feature designed-in EMC shielding and readily accept standard plug-in units and backplanes. They're available as desktop or rack-mount models (with or without front handles). Conversion from one to the other is easy with interchangeable front trims, handles, and 19-in. mounting brackets. External dimensions are in keeping with DIN 41494 Part 1. Pricing for a 3U/42HP case without rear covers starts at $140. Units are available assembled or in kit form. DM



Schroff Inc., 170 Commerce Dr., Warwick, RI 02886; (800) 451-8755. **CIRCLE 785**

TWO PGA SOCKETS HOUSE INTEL'S PENTIUM

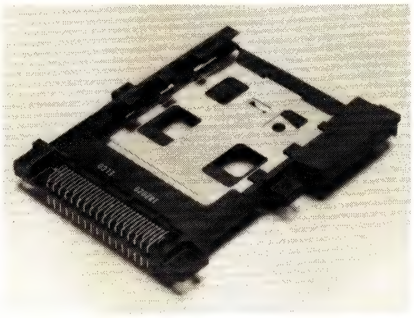
A pair of 273-position pin-grid-array (PGA) sockets are available for Intel's Pentium processor: a zero-insertion-force (ZIF) socket specifically designed for the processor as well as a low-insertion-force (LIF) model. The ZIF socket features single-lever handle operation of a free-moving cam allowing substrate pins to be inserted and extracted without force. The LIF socket requires average per-pin forces of 0.5 oz and features 30-μin. gold-plated contacts of staggered heights. Pricing for the ZIF and LIF sockets is $9 and $7, respectively, in lots of 1000. Small quantities are delivered from stock. DM



AMP Inc., P.O. Box 3608, Harrisburg, PA 17105-3608; (800) 522-6752. **CIRCLE 786**

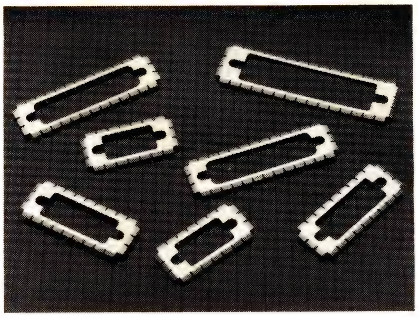
PCMCIA CONNECTORS ACCEPT HARD DISKS

A line of PCMCIA sockets and connectors is designed for the demanding requirements of PCMCIA Types I, II, and III as well as JEIDA Version 4. The 68-position pin-and-receptacle connectors come with 1.27 mm pitch on sockets and 0.050 and 0.025 in. spacing on receptacles. Their ejector structure facilitates insertion and ejection of memory cards and features removable connector and ejector parts. Call for pricing and delivery. DM



Elco Corp., 8611 Balboa Ave., San Diego, CA 92123-1580; (619) 576-2669. **CIRCLE 787**

CONNECTOR GASKETS HOLD EMI/RFI AT BAY



A line of beryllium copper and stainless-steel connector gaskets provide EMI and RFI shielding and grounding for a range of D-subminiature connectors. The D connector series is designed with miniature fingers on all four sides in place of the typical solid-flange design. This system more readily closes gaps resulting from fabrication tolerances and misaligned or irregular surfaces than does a solid flange. Available with numerous plating options, the gaskets can be installed from the front or rear. They fit most 9- through 50-pin D connectors. Call for pricing and delivery. DM

Tech-Etch Inc., Dept. D, 45 Aldrin Rd., Plymouth, MA 02360; (508) 747-0300. **CIRCLE 788**

SMT ZENER PACKAGE EASES PROCESSING

Three complete series of Zener diodes are now available in the surface-mounted plastic SOD-123 package. These devices replace the leadless 34-package style, which has a tubular shape and a tendency to roll. The SOD-123 devices fit on the same footprint as the leadless devices, so there's no need to redesign boards. One series, the MMSZ5221BT1, has a voltage range of 2.4 to 91 V. Pricing is $0.072 in lots of 3000. Delivery of samples and small quantities is from stock. DM

Motorola Inc., MD Z208, 5005 E. McDowell Rd., Phoenix, AZ 85008; (602) 244-3742. **CIRCLE 789**

TINY EEPROM PACKAGE SUITS PCMCIA CARDS

The smallest packaging option available for EPROM and parallel EEPROM memories is Microchip Technology's very-small-outline package (VSOP). The package maintains the thinness of the company's thin small-outline package (TSOP) but reduces area consumption by 35%. The VSOP measures 8 by 13 mm, making it a suitable option for PCMCIA cards, notebook and palmtop computers, smaller disk drives, and hand-held instruments. Call for pricing. DM

Microchip Technology Inc., 2355 W. Chandler Blvd., Chandler, AZ 85224-6199; (602) 786-7200. **CIRCLE 790**

"I'm a vice president because I sold 22,000 gizmos this year. How'd you become a v.p.?"
"I made a great deal on the 200,000 gizmos you didn't sell last year."

Turn your **excess inventory** into a tax break and help send needy **kids to college**.

Call for your **free guide** to learn how donating your slow moving inventory can mean a generous **TAX WRITE OFF** for your company.

Call **708-690-0010**

EAL

P. O. Box 3021, Glen Ellyn, IL 60138 FAX (708) 690-0565

Excess inventory today...student opportunity tomorrow

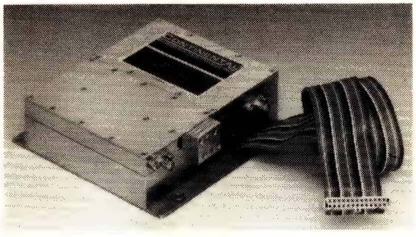
QUAD FLAT PACK IDEAL FOR PORTABLES

A reduced package for the 68302 Integrated Multiprotocol Processor is ideal for mobile computing applications. The 144-pin Thin Quad Flat Pack is an area reduction of 38% and a thickness reduction of 65% from the 302's standard Plastic Quad Flat Pack. This optimizes the 302 for the emerging PCMCIA card market for portable computing. The component footprint was reduced 38%. The profile of the chip was reduced by 65% from 4.32 mm with the PQFP to 1.5 mm. The 144-pin TQFP version of the 302 costs $19.99 in quantities of 10,000 units. The standard PQFP is also available now in similar quantities for $17.99. CM

Motorola, Microprocessor and Memory Technologies Group, 6501 William Cannon Drive West, Austin, TX 78735-8598; Rex Kiang, (512) 891-2429. **CIRCLE 791**

MICROWAVE SYNTHESIZER KEEPS SPECTRUM PURE

Excellent spectral purity and low microphonics are features of the S-Series microwave synthesizer. The series covers the frequency range of 600 MHz to 13 GHz with typical bandwidths of 600 MHz and step size of 125 kHz. The typical phase noise of a 4.7-to-5.3-GHz unit is –80 dBc at a 1-kHz offset, –85 dBc at a 10-kHz offset, and –110 dBc at a 100-kHz offset. Call for pricing and delivery. DM

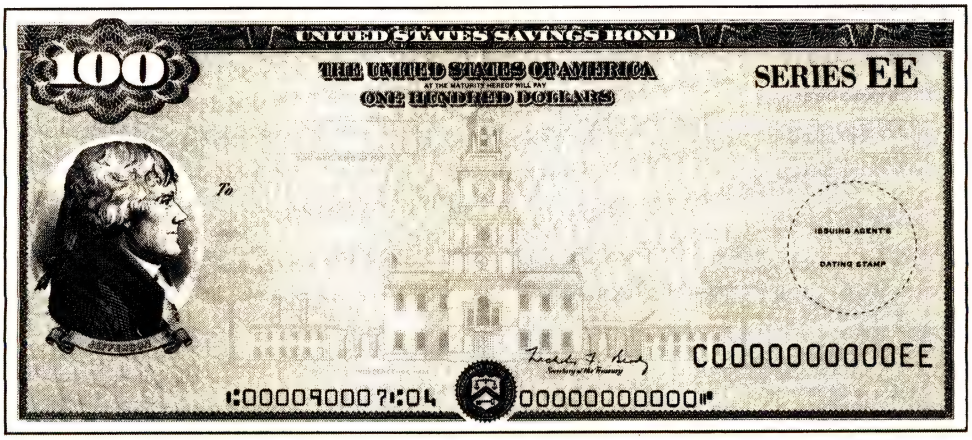


Continental Microwave Technology Inc., 7 Alexander Pl., Glen Cove, NY 11542; (516) 759-5600. **CIRCLE 792**

POCKET MODEM LINKS TO 3270 SNA HOSTS

The Gemini Mini SNA product includes PC software and a pocket modem that enables a PC's standard communication port to transmit a synchronous 9600 bits/s SNA data stream. The unit uses any standard PC serial com port for both SNA and asynchronous connectivity. As a result, PC users don't need to add boards for a synchronous serial port—PC slots can be saved for memory or color boards. Direct dial-up connections to the host are at V.32 speeds remains intact. After an SNA session, users can simply dial up any asynchronous-based application without recabling the modem connection or entering extended commands. The unit is $995 with 3270 SNA software. SVT

Galaxy Networks Inc., 9348 De Soto Ave., Chatsworth, CA 91311; (818)998-7851;fax-1758. **CIRCLE 793**



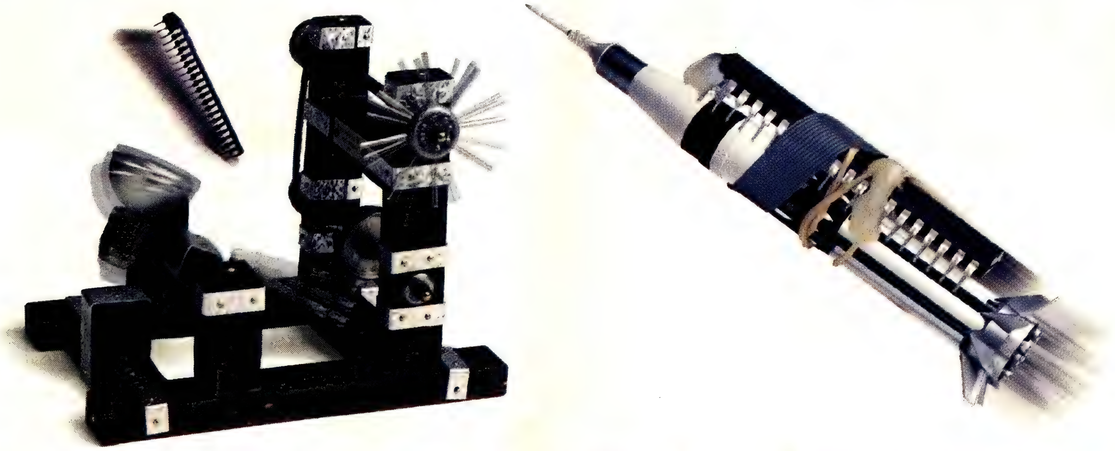
This Is A Happy Retirement

It's the peace of mind you get knowing you have saved for the future. It's a U.S. Savings Bond. With just a little from each paycheck, you can invest in Bonds through the Payroll Savings Plan where you work. And they will keep earning interest for up to 30 years. Make an investment in your future with U.S. Savings Bonds today. Ask your employer for details.

U.S. Savings Bonds

A public service of this publication.

Running out of tricks to make the 8051 go faster?



Try the only 8051 built for speed.

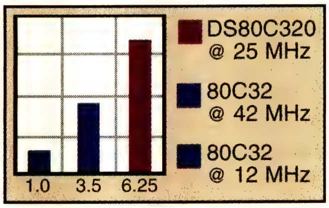
Since its introduction a short time after the dark ages, the 8051 hasn't really improved. Until now. The DS80C320 High-Speed Micro runs up to three times faster than other 8051s using the same crystal.

Fewer Clocks for Greater Performance

We redesigned and updated the architecture using four clocks per instruction instead of the usual 12. You needn't be a math whiz to figure out that when the same instruction takes 1/3 the clocks, software can do more in less time.

Drop In For Speed

The DS80C320 is a drop-in replacement for 80C31- or 80C32-based designs. So you can plug it into your system with no redesign and get an instant performance improvement, regardless of the speed at which your system runs. With an adjustable speed interface to RAM and peripherals, the DS80C320 is easy to adapt to existing hardware.



The DS80C320 outperforms other 8051s even when they use higher clock speeds. A DS80C320 running up to 25 MHz can do almost twice as much work as a standard 8051 running at over 42 MHz.

At its top speed of 25MHz, the DS80C320 performs an instruction cycle in 160 ns. And you can look for higher speeds from Dallas soon.

Long-Awaited Improvements

But speed isn't the only improvement we've made. For example, we've added a Dual Data Pointer. A second, full-function UART that is completely independent from the original. Six external interrupts instead of the usual two. A power monitor that provides early-warning interrupt and power-fail reset. Even a programmable watchdog timer.

The DS80C320 offers all these features, with no external components, in the standard pinout. It's still fully 8051 instruction set-compatible and offers the familiar 256 bytes of RAM and three 16-bit timers.

To see what the **8051 for the 90s** can do for your design, give us a call.

DALLAS SEMICONDUCTOR

4401 South Beltwood Parkway • Dallas, Texas 75244 • Telephone: 214-450-0448 • Fax: 214-450-3715

CIRCLE 108 FOR U.S. RESPONSE

CIRCLE 109 FOR RESPONSE OUTSIDE THE U.S.

64-KBIT NVSRAM AUTOMATICALLY STORES DATA ON POWER LOSS

Although previous-generation non-volatile static RAMs can store the RAM cell contents into EE PROM shadow cells on command, sometimes the host system or surrounding circuits can't generate the proper signals. Now, the STK12C68, a 64-kbit nvSRAM with built-in AutoStore logic from Simtek can supply its own store command when it senses a dropping power-supply level.

When a power loss is detected, on-chip circuits disconnect the chip from the main power source and let it draw power from a small, external, 100-μF capacitor. The circuit then initiates an automatic store operation and transfers the contents of all the RAM cells to the shadow EE PROM. When the power is restored, data is automatically read from the non-volatile storage area and reloaded into the on-chip SRAM. The nvSRAM also has a Store control pin for occasions when the host system has to initiate a store cycle.

The STK12C68 is organized as 8-kwords by 8-bits and comes in three speed grades—30, 35, and 45 ns. At maximum speed the nvSRAM draws a maximum of 95 mA from a 5-V supply. When clocked at 1 MHz, the chip draws a modest 20 mA, while on standby it needs as little as 2 mA. Once the power is removed, data is safely stored so no power is needed to maintain the data. Simtek's patented NOVCEL (SRAM cell plus shadow EE PROM cell in one), lets the chip offer a 10-year data retention for up to 10^4 or 10^5 store cycles. Furthermore, the contents of the EE PROM cells can be read out an unlimited number of times.

In thousands, the 45-ns commercial temperature range STK12C68 sells for $10.49 a piece, in either a plastic DIP or SOIC package. An industrial temperature-grade version is available; a military temperature version is in development.

***Simtek Corp.**, 1465 Kelly Johnson Blvd., Colorado Springs, CO 80920; David Bowers, (719) 531-9444.* **CIRCLE 794**

■ *DAVE BURSKY*

MIDI CHIPS BREAK PRICE BARRIER AND OFFER 32-VOICE POLYPHONY

A pair of music synthesis chips from Crystal Semiconductor are among the first to deliver compatibility with the Roland General Synthesizer enhancements to the General MIDI (Musical Instrument Digital Interface) specification.

Both chips are application-specific digital-signal processors. The lower-priced CS8905 can generate 16 notes simultaneously with a high-quality, 16-bit-stereo, digital-audio output at a 44.1-kHz sampling rate. Designers can opt for up to a 1M-by-12-bit sample set in the wave table that provides sampled sounds for the synthesizer. In combination with the wave table, the CS8905 offers an impressive musical palette consisting of 188 melodic timbres, 91 drum sounds, and 46 special-effect sounds.

The CS9203's faster processor provides a higher range of capabilities. It offers 32-note polyphony, for example, and two 16-bit-stereo digital outputs. The chip can address wave table samples as large as 8M-by-12 bits. It can generate up to 191 melodic timbres, 118 drum sounds, and 46 special-effect sounds.

The two chips can be used together to create a powerful synthesizer with digital effects. Both chips come in 68-pin PLCCs and are sampling now. Production level quantities will be available in the third quarter of 1993. In 1000-unit purchases, the CS8905 is $24 each and the CS9203 is $36.50 each.

***Crystal Semiconductor Corp.**, P.O. Box 17847, 78760, 4210 S. Industrial Dr., Austin, TX 78744; (512) 445-7222.* **CIRCLE 795**

■ *JACK SHANDLE*

HIGH-SPEED PLDS TRIM DELAYS TO 5 AND 6 NS

Trimming the propagation delay on the GAL16V8 and 20V8 to just 5 ns, and on the GAL22V10 to just 6 ns, Lattice Semiconductor claims the speed crown for both as the fastest CMOS PLDs. With a maximum operating frequency of 166 MHz, the GALs serve well in data encoding/decoding applications, memory cache address decoders, and state machines. The GAL16V8C-5L and GAL20V8C-5L emulate all standard 20- and 24-pin DIP-based (or 20- and 28-lead PLCC housed) bipolar PLDs, yet they offer 100% testability thanks to electrically reprogrammable configuration structures. When active, the 16V8C and 20V8C consume about 75 mA when powered by a 5-V supply; the GAL22V10 consumes about 90 mA—about half the power of the closest bipolar equivalents. The PLCC-housed GAL16V8C-5L costs $7.50 each, the 20V8C-5L is $11.25 each, and the 22V10C-6L costs $13.50 each—all in 1000-unit lots. DB

***Lattice Semiconductor**, 5555 Northeast Moore Ct., Hillsboro, OR 97124-6421; Steve Stark, (503) 681-0118.* **CIRCLE 796**

BLOCK-ORGANIZED FLASH MEMORY HOLDS 4 MBITS

Offering 32 individually reprogrammable storage blocks, each with 10,000 program/erase cycles, the M5M28F400 4-Mbit flash memory can be user configured as 256 kwords by 16 bits, or 512 kwords by 8 bits. The electrically reprogrammable blocks can be read when the chip is powered by a 5-V supply. When active the flash memory can be accessed in 100, 120, or 150 ns (depending on the speed selected) and draws just 30 mA; when not being accessed it can be turned off to conserve power. Samples are available in 44-lead plastic SOP or 48-lead plastic TSOPs. In lots of 10,000, the flash memories will cost about $40 each.

***Mitsubishi Electronics America Inc.**, 1050 East Arques Ave., Sunnyvale, CA 94086; (408) 730-5900.* **CIRCLE 797**

We're not just number one in the world... we're number ISO 9002!

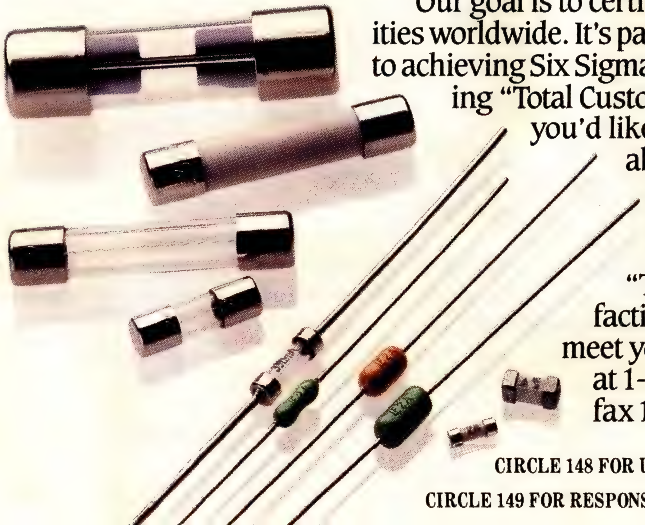
In today's global marketplace your suppliers have to be more than number one. They have to have an ISO 9000 number, too!

That's why at Littelfuse we give you both.

Our most recent certification of our Centralia, Illinois facility to ISO 9002 by INTERTEK is our second U.S. facility and our fourth facility worldwide to have earned ISO 9000 registration. No other U.S. circuit protection fuse manufacturer can claim to have certified even one of its domestic facilities.

To our customers, the ISO 9002 certification of our small dimension and surface mount fuse manufacturing facilities in Centralia, Illinois and in Washington, England serve as independent confirmation that Littelfuse is better able to meet your quality systems expectations.

Our goal is to certify all Littelfuse facilities worldwide. It's part of our commitment to achieving Six Sigma quality and providing "Total Customer Satisfaction." If you'd like more information about how Littelfuse ISO registration, Six Sigma quality objectives and "Total Customer Satisfaction" programs can meet your needs, call us at 1-708-824-0400 or fax 1-708-824-3024.



Littelfuse®

Littelfuse Inc.

CIRCLE 148 FOR U.S. RESPONSE

CIRCLE 149 FOR RESPONSE OUTSIDE THE U.S.

ELECTROLUMINESCENT FOIL LAMPS

A new four-page data booklet from Electroluminescent Technologies Corp. (ELtech), Horsham, Penn., provides descriptions, design criteria, and dimensional data on the company's new series of fusion-sealed, Aclar encapsulated EL foil lamps, which provide high performance at low cost. ELtech, through its new 100/50 process, has developed a foil lamp that delivers 30-40 fL at 120 V, 400 Hz with a time to half brightness of about 800-1,000 hours. Yet the lamp is priced closer to a screen printed polyester lamp than an EL foil lamp produced by traditional "one-up" methods. Copies of "Low Cost, High Performance EL Lamps" are free. CM **CIRCLE 899**

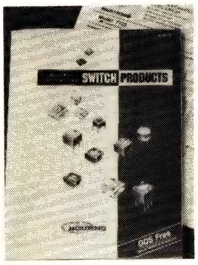
DESIGNER'S DATA BOOK DETAILS PHOTODIODES

Silicon photodiodes are featured in a 128-page optoelectronics data book from EG&G Vactec, St. Louis, Mo. The reference manual represents a comprehensive guide to understanding, selecting, and configuring a myriad of conventional photodetector circuits using over 100 standard silicon-photodiode products. Clear, concise technical descriptions are supplemented by a complete selection guide and full specifications for each type of photodiode. DM **CIRCLE 900**

DATA BOOK COVERS LAN MAGNETIC COMPONENTS

From FCI Components, San Jose, Calif., a 64-page data book describes mini dc-dc converters, delay lines, pulse transformers, magnetic modules, BNC connectors for networking, LAN, T1, ISDN, Token Ring, and other communication circuits. The book includes electrical specifications and data on packaging and applications. SVT **CIRCLE 901**

SWITCH CATALOG



Catalog SW-1, dedicated exclusively to ultra-mini switch products from Bourns Inc., Riverside, Calif., covers four switch categories: rotary, selector, coded, and key. These all are available in through-hole and SMT configurations and in sizes from 3 through 6 mm. Some come with either top or side actuation. The catalog contains electrical, general, mechanical, and environmental characteristics for all devices. Part drawings and package specifications, along with ordering instructions, are included. DM **CIRCLE 902**

CATALOG DESCRIBES TEST EQUIPMENT

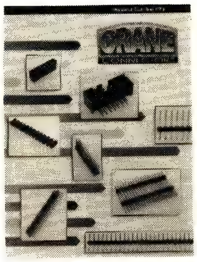
A catalog from National Electric and Instrumentation, Elizabeth, N.J., details descriptions of electronic test equipment and service tools from many manufacturers. The catalog lists digital multimeters, component testers, oscilloscopes, signal generators, counters, dc power supplies, programmers, and specialty products. JN **CIRCLE 903**

BATTERY BROCHURE OUTLINES CAPABILITIES

Custom Designed and Standard High-Energy Density Lithium/Thionyl Chloride Batteries
BATTERY ENGINEERING, INC.

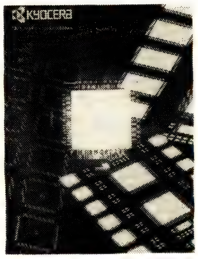
Design, engineering, research and development, quality-control, and production capabilities are covered in a brochure on lithium/thionyl chloride batteries from Battery Engineering Inc., Hyde Park, Mass. The custom-made batteries serve industrial, military, commercial, and medical applications. The catalog provides a description of these power sources, their electrochemical systems, cell construction, and advantages compared with other battery types. DM **CIRCLE 904**

PC-BOARD CONNECTORS



A broad line of pc-board connectors is described in the latest edition of the full-line catalog from Crane Connectors, Cincinnati, Ohio. Surface-mount, through-hole, and high- and low-profile types are all included in Crane's line of headers, sockets, and jumpers on 2-mm and 0.100-in. centers. Mated board-stacking choices range from 0.225 to 1.5 in. Custom and special connectors are also available. DM **CIRCLE 905**

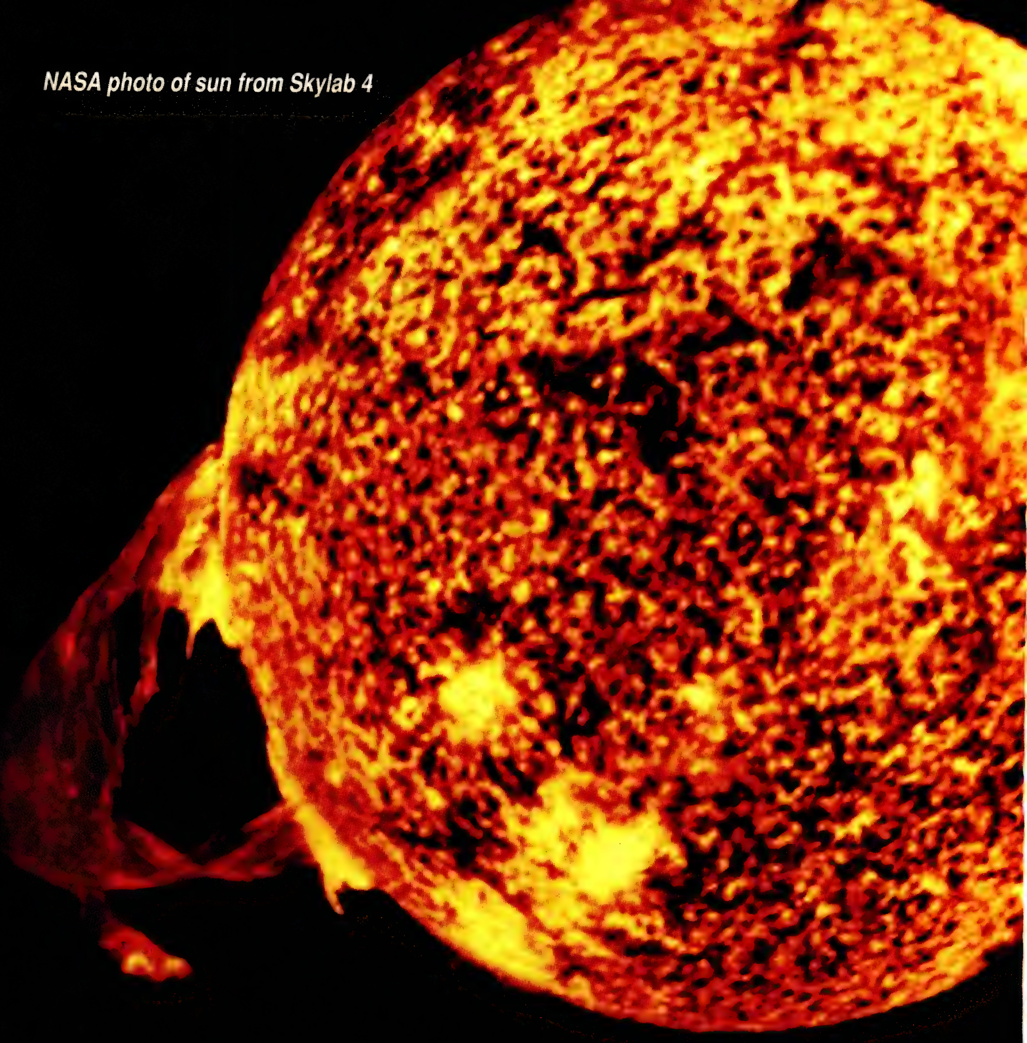
BROCHURE OUTLINES MCM CAPABILITIES



Ceramic multichip modules (MCM-C) and ceramic MCMs with thin-film deposition (MCM-D) are featured in a color brochure on multichip capabilities from Kyocera America Inc., San Diego, Calif. Details of MCM-C and MCM-D technology are included as are comparisons of MCM ceramic materials including alumina, aluminum nitride, silicon carbide, mullite, low-temperature cofired ceramic, and low-epsilon ceramic. The brochure also offers MCM-design guidelines and details of Kyocera's design, simulation, and subcontract-assembly capabilities. DM **CIRCLE 906**

BROCHURE DETAILS SIMULATION SOFTWARE

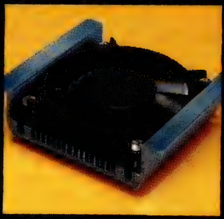
A free, eight-page brochure from AT&T Istel Visual Interactive Systems Inc., Beachwood, Ohio, highlights the advantages of Witness Simulation Software to build improved production reality, including improved user friendliness, pull-down menus, support services, and compatibility with leading operating systems, hardware, and networks. SVT **CIRCLE 907**



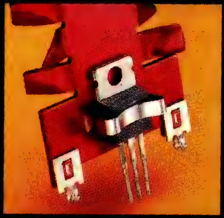
NASA photo of sun from Skylab 4

We cool the hot spots around the world.

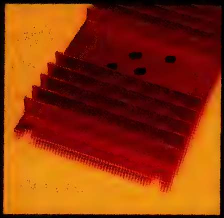
We cool the whole wide μP world.



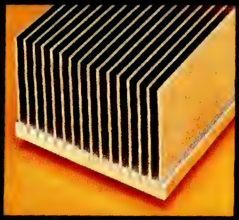
You get a world of stamped designs.



More extrusions than anyone—anywhere.



The higher the power, the more we can help.



For the full range of possibilities in cooling semiconductors, you need to talk to Aavid Engineering. No one offers you more choices. *No one.*

More product choices. For starters, we offer you over 3000 extruded and 500 stamped designs—all tooled. There's a full range of bonded fin, liquid cooled and cast products. From Intel's Pentium™ μP to DEC's Alpha, we have heat sinks for every μP. Nobody else comes close. *Nobody.*

More ways to attach. Snap on. Slide on. Plug in. We give you more *quick,* labor saving methods for mounting. Devices to heat sinks. Heat sinks to boards. *More than anyone.*

More design capabilities. We offer the world's best solutions for packaging high power density electronics. With the most advanced engineering team ever assembled, we can resolve any thermal management challenge—and deliver state-of-the-art solutions.

Call for immediate help— wherever you are around the world. Or send for literature.

One Kool Path
Laconia, NH 03247-0400
TEL: 603-528-3400
FAX: 603-528-1478

Also Santa Ana, CA, England and Singapore

AAVID™

AAVID ENGINEERING, INC.

WE LEAD THE THERMAL MANAGEMENT WORLD

Pentium is a registered trademark of Intel Corp.

SEE US AT WESCON, BOOTH # 1936

CIRCLE 80 FOR U.S. RESPONSE

CIRCLE 81 FOR RESPONSE OUTSIDE THE U.S.

READERS RESPOND TO QUESTIONS IN 'EMF UPROAR' EDITORIAL

The Editorial in the July 8 issue, "The EMF Uproar," (p. 14) expressed some puzzlement over the way in which power-frequency electromagnetic fields could affect the human body and pointed out the need for more scientific evidence. It also summarized a simple calculation of the magnetic field strength required to break a molecular bond, which would thus affect human tissue. The Editorial elicited several comments and rebuttals from readers. Here are as many as space allows:

PERHAPS THE EFFECTS ARE CUMULATIVE

I read with great interest your editorial in the July 8 issue. As an Electrical Engineer with no experience in the power generation and transmission industry, I agree with you with only one caveat. Can exposure be cumulative? I cite as an analogy airport x-ray effects on photographic film.

As you know, the x-ray systems used in airports today all claim to be safe for photographic films and in fact they are. However, this is only true if the film passes through only one time. X-ray effects are cumulative to the film. What this means is that 10 passes through an airport x-ray will fog film, even though each pass was in itself undetectable.

I do not think that effective studies on EMF effects on the human body have been conducted as yet; we are suffering from a wave of hysteria. More scientific studies are needed before we overreact. However, until that time, even though I agree with you, I do not wish to live beneath high-tension power lines.

HARLEY A. BURTON
DALLAS, TEXAS

REEXAMINE THEORY, DON'T IGNORE EVIDENCE

This is in response to your editorial in the July 8 issue regarding the effects of low-frequency electric and magnetic fields on biological systems. You prefaced your editorial by stating that you are a lay person in the field of EMF effects. That is about the only useful statement that your piece contained.

It has been thoroughly established by laboratory experiments (not "statistical studies", i.e. epidemiology, as you suggest) that low-frequency magnetic fields can influence a variety of cellular systems and processes. I have enclosed a paper[1] that gives a brief overview of some of the experimental evidence to date, and discusses a possible mechanism for interaction between weak fields and biological systems. It should be noted that the quantum-mechanical mechanism the authors discuss is independent of the supposed requirement of breaking molecular bonds, and is based on a well-accepted magneto-chemical phenomenon.

I must also point out that the fields from "man-made power devices for home use" are not limited to a few milligauss as you suggest, nor to 60-Hz field emission. Studies at Pacific Northwest Laboratories[2] have shown that everyday appliances such as hair dryers and electric razors can produce fields up to 1 mT (10,000 milligauss) with frequency components up to 100 kHz. This is in addition to the obvious case of occupational exposure to people working near very large motors, induction heaters, etc.

Your statements about the epidemiology "now coming under question" and "we need something more scientific" make your personal point of view quite clear. Let me offer the counterpoint that your source's simplistic dismissal of nearly two decades of investigation is precisely what this question does not need. In fact, such proclamations from those with little or no familiarity with the existing literature only serves to cloud the issue, and to further alienate those who are concerned about possible negative effects.

What is needed instead is the realization that the fundamental goal of scientific investigation is to understand our surroundings. When a body of evidence accumulates that cannot be explained by existing theory, one should reexamine the theory, rather than ignore the evidence. The enclosed paper should suffice to demonstrate that it may well be possible to explain the observed EMF effects without throwing out accepted physical principles if we'll only set aside our biases and preconceptions.

References:
1. Grundler, W., Kaiser, F., Keilmann, F., Walleczek, J: Naturwissenchaften 79, 1992; p. 551-559.
2. Wilson, B., Lovely, R., Davis, K., Hansen, N.: "Magnetic Flux Density and Spectral Characteristics of Personal Appliances," 15th Meeting of the Bioelectromagnetics Society, Los Angeles, June 1993.

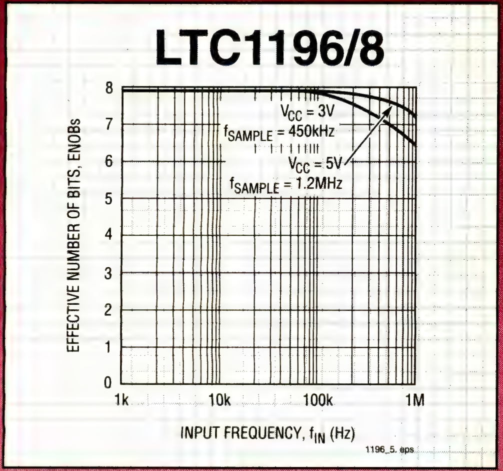
ROBERT A. JONES
RUNNING SPRINGS, CALIF.

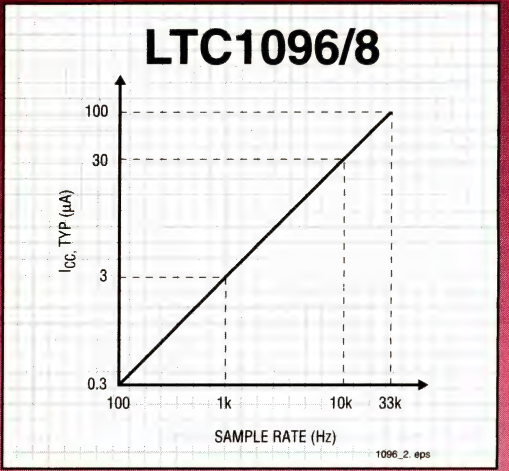
PURELY STATISTICAL, BUT WHAT OF IT?

Usually your editorials are well thought out and make points that are clear as well as thought provoking. Your July 8 editorial (The EMF Uproar), however, was not one of those. Unfortunately, it sounded more like the statements we have come to expect from the Tobacco Institute than from a legitimate engineering journal.

You state that the evidence for negative effects from low-frequency exposure is purely statistical. What of it? So is the evidence against tobacco! Yet even at least one

NEW SO-8 ADCs
1 MSPS or 3V-3μA





For high speed or micropower applications, Linear Technology provides the highest performance, most compact sampling 8-bit A/D converters at the lowest cost.

The high speed LTC1196/8, 600nsec 8-bit ADCs are designed and specified for 3V and 5V systems and squeezed into tiny SO-8 packages. Their high speed serial ports ease signal wiring and can transfer data at 12MHz bit rates to ASICs and PLDs. (Application assistance for interfacing to common PLDs is available.) Sampling at up to 1MSPS, their high impedance inputs digitize 1MHz signals to an accuracy of greater than 7 effective bits.

The LTC1196 has a differential input while the LTC1198 digitizes 2 input channels and automatically powers down to 1nA between conversion. With a typical power dissipation of 50mW at 5V and 10mW at 3V, the LTC1196/8 provide the best combination of performance, power, board space and cost available.

For micropower applications, the LTC1096/8 has extremely low supply currents which automatically scale to the sample rate. The typical current drain from a 3V or 5V supply varies linearly from 3μA at 1KSPS to 100μA at 33KSPS. The ADCs also automatically power down between conversions.

The 2.7V minimum supply and SO-8 package are ideal for battery powered, hand held instruments and equipment. The serial I/O reduces opto-isolation cost and is compatible with SPI, Microwire, and other common serial formats.

Whether you are looking for high speed or micropower 8-bit sampling ADCs, you won't find higher performance, more compact, lower cost solutions anywhere.

Pricing in 1000 up quantities for LTC1196 starts at $2.37 and $2.85 for LTC1096. For more details, contact Linear Technology Corporation, 1630 McCarthy Boulevard, Milpitas, California 95035/408-432-1900. For literature only, call **800-637-5545.**

LINEAR
TECHNOLOGY

TOUGH PRODUCTS
FOR TOUGH APPLICATIONS.

CIRCLE 146 FOR U.S. RESPONSE

CIRCLE 147 FOR RESPONSE OUTSIDE THE U.S.

spokesman for the Tobacco Institute has admitted that tobacco use causes cancer (I heard him say it). We still do not know the specific biochemical processes involved, nor how a virus causes tumors to form, but there is no doubt at all that tobacco use does indeed cause cancer. What, then, is the difference between the epidemiological studies of tobacco use and those of EMF exposure? For tobacco, the studies are both legion and overwhelming, while for EMF exposure the studies are still few and the results tentative, just as were the early tobacco studies. Therefore, your dismissal of the EMF studies as merely statistical is premature at best.

As for the calculations by Dr. Holbrook, this is not "...exactly the type of fundamental analysis that's needed..." The calculations are the sort of specious science one expects of someone defending a viewpoint (again, a la the Tobacco Institute). They were made in a vacuum, with no regard as to what the complex engine of the human body is really doing, as if bought by some power industry group. It should be obvious that induced magnetic effects (did the paper deal with the effects of electric fields as well?; apparently not) are not the only energetic process in a body. The energy imparted by a magnetic field need not be strong enough to break a chemical bond, only strong enough to aid some other process in doing so, or even preventing a bond that needs to be broken from being so. And bond *breaking* is not the only issue. EMF effects could aid or prevent bond formation as well, or tip the energy balance of a system to favor or inhibit some process, any or all of which could lead to cancer or other diseases. Or more to the point, lead not to disease, but to an excess of disease over what would normally be expected, which is what these studies are really pointing to.

I do agree with your last sentence: "Solid scientific evidence is needed now—not a massive public-relations campaign or an electrical counterpart of Joe Camel." Alas, it is your editorial that sounds like propaganda, and I would urge you to be more thoughtful in the future, and try not to sound like a lobbyist for the power industry. Certainly the electrical/electronics industry has been good to you, but to defend it with this sort of editorial is both beneath you and counterproductive.

Before you dismiss me as a lobbyist for the statistics industry, I am not. I simply haven't made up my mind about the effects of low-frequency, low-intensity electric and magnetic fields on the human body. Like you, I think it seems unlikely. But unlike you, I do not merely dismiss epidemiologic (statistical) studies simply cause they are now few and not overwhelmingly convincing. Nor do I uncritically embrace someone's studies because they are couched in what appears to be fundamental principles and non-statistical mathematics. I, too, want evidence, but I want it related to the real world, not to some intellectual exercise. And I'll wait on the epidemiology to see if it really does produce the kind of statistical links that will finally convince people that something/nothing is happening.

Anyway, thanks for bearing with me, and for taking the time to read, and hopefully for thinking about the points I have brought up.

K. A. BORISKIN
BELLINGHAM, MASS.

ADJACENT POWER LINES: HEART-MONITOR FAILURES

In your editorial of July 8, you discuss one factor to be considered in the low-energy EMF controversy. I do not disagree with what you said; I tend to hold a conservative position myself.

However, I have a thought that might be worth sharing. It does not take, at the antenna, enough energy to smoke a transistor to destroy the message being passed by radio. A short burst of static is enough to damage the communication.

As a "weekend warrior" athlete, I use a heart monitor. There are stretches of country road, and occasionally city streets, where my heart-rate monitor fails for blocks at a time. The failures are always repeatable both as to direction of travel and to any time or day for any particular stretch. And when there is a failure, there are always power lines adjacent.

Of course, passing under the high-voltage lines always causes interference. But the lines I am talking about appear to be only normal distribution lines. The problem may be a block long, or a mile.

I do not know what the cause is, only that the monitor works fine in the house, and on the road, most of the time. I am not inferring that the interference with the monitor equates to a health problem. I just wonder if damage might occur from the EMF if it can interfere with inter-cellular messages within the body.

And, with respect to the strength of magnetic fields relative to the earth's, only a very small field is necessary to cause a compass to misread the earth's much larger field. Not that this means anything; it just occurs as a question in my mind.

Thanks for your editorial, and for this opportunity to talk with you.

HORACE SIMMONS
PORTLAND, ORE.

ARE EXPERTS LOOKING IN THE WRONG AREAS?

I recently read your July 8 editorial titled "The EMF Uproar." I found the article most interesting and it reminded me of an article I had read last winter. I have been in the RF design field for 30 years and have more than a passing interest in the effects of EMF/RF. The article I read last winter was published in England in Electronics World + Wireless World in the November, 1992 issue in England. The article is titled: "Natural Radiation Focused By Power Lines: New Evidence." The article suggests that experts have been looking in the wrong areas for the reason why cancer/leukemia and other types of illness appear to have a higher incidence rate in people living near high tension lines.

Although scientists have focused on high-energy particles around power lines, Anthony Hopwood found evidence of the concentrating effect of low-energy, biologically

The smallest, most powerful personal programmer you can buy!

Owning the worlds best selling portable programmer/ emulator is just a phone call away. From engine management to Antarctic survey teams, the powerful and versatile S4 goes where others get left behind.

Only
$795
4 Mbit upgrade $150
Full 30 day money back guarantee!

A 32 pin ZIF socket programs a huge library of EPROMs, EEPROMs and FLASH devices up to 8Mbit. And our unique user loadable Library means that new parts can be added quickly, and at no cost. All software upgrades are free and available for 24hr download from our high speed bulletin boards.

Emulation

See your code running before committing yourself to an EPROM. With S4's powerful and easy-to-use internal emulation system, download your code to S4, press 'EMULATE', and your target system runs in real time as if an EPROM was plugged in to the socket. Use S4's 'EDIT' command to make minor alterations to your code and see the changes happen *immediately* - just one reason why S4 is used by the world's car manufacturers to develop advanced engine management systems in real time! With S4 emulation there's no need for trailing cables or external power sources; earth loop problems are a thing of the past. S4 even emulates RAM.

Remote Control

As well as being totally stand alone and self contained, S4 can be operated remotely via it's serial port at speeds up to 115,200 Baud. We supply you with a FREE disk containing custom terminal software and a pop-up TSR communications utility.

The Company

If you are looking for a supplier with longevity and stability, then you'll be pleased to learn that Dataman has been designing and selling innovative programmers world-wide for over 15 years. As well as having sales and support offices in both the USA and the UK, we supply the world demand for our products via a network of approved dealers stretching from Norway to Australia.

The Package

S4 comes fully charged and configured for immediate use. You get a mains charger, emulation lead, write lead, personal organiser instruction manual, MS-DOS communications software, spare Library ROM and a 3 year guarantee. Optional modules available for serial EPROMs, 40 pin EPROMs and microcontrollers.

Availability

S4 is always in stock. Phone through your credit card details to ensure *next working day* delivery. Full 30 day no-risk refund.

Size:
7.3 x 4.4 x 1.8 inches
Weight: 18 ounces

DATAMAN
Dataman Programmers Inc

Order hotline:
(800) 328 2336
for same-day dispatch

MasterCard VISA

22 Lake Beauty Drive, Suite 101, Orlando, FL 32806, U.S.A. Telephone: (407) 649-3335; Fax: (407) 649-3310; BBS: (407) 649-3159 24hr; Modem: V32bis/16.8K HST
Station Road, Maiden Newton, Dorset DT2 0AE, UK. Telephone: 0300 20719; Fax: 0300 21012; Telex: 418442; BBS: 0300 21095 24hr; Modem: V32bis/16.8K HST

CIRCLE 353 FOR U.S. RESPONSE
CIRCLE 354 FOR RESPONSE OUTSIDE THE U.S.

destructive particles along the length of the power line. This exposed anyone living and working nearby to at least double the normal sky radiation dose. During the periods of high solar activity, the situation is even worse. Background radiation also experiences the same effect. The author presents his measurement technique, some graphs of data, and photographs to substantiate his claim.

The article is most interesting and although I certainly am not an expert in this area, what he says tends to make sense since the link between nuclear ionizing radiation and leukemia/cancer is well known. Remember Chernobyl and what happened to the people nearby.

Much research is still needed in this field, but this article should give readers a different perspective. Possibly someone may come up the answer to end the debate.

LOWELL ATKINSON
INDIANAPOLIS, IND.

CAN'T ASSUME A PARTICULAR MECHANISM

In your recent editorial "The EMF Uproar," you pooh-poohed a Swedish study as being "based purely on statistical studies" while you champion a PhD's (dare I say back-of-envelope?) calculation as "the type of fundamental analysis that's needed to get to the bottom of this matter."

The fundamental problem with your champion's approach is that he assumes a particular mechanism. While I do not claim to have particular expertise in this area, this assumption seems highly presumptuous. Can we exclude all other mechanisms, known and unknown? We don't need to look very far back in history to recognize similar flaws in our scientific thinking.

More specifically, your champion estimated that a magnetic field of 1-gauss intensity is 11 orders of magnitude too weak to affect biological tissue. In a recent news item reported in the journal *Science*[1] researchers from UC Santa Barbara and the University Hospital in Zurich reported measuring "epilepsy-like" brain activity induced in epileptic patients in response to a magnetic field of about 50 gauss. This is about 9 orders of magnitude shy of your expert's minimum necessary field strength.

Sure, this is still considerably higher than levels we are normally exposed to, even those of us who spend much of our lives around electrically powered equipment. I do not suggest the fear-mongers have the truth. But we do not serve anyone's cause by making such broad, unscientific, and ultimately fallacious statements. Please correct this before the public has one more reason to disbelieve our (hopefully truthful) story.

Reference:
1. "Magnetism Triggers a Brain Response" *Science* 260 (11):1590. 1993

FRANK P. MILES
SEATTLE, WASH.

WHAT ABOUT THE REST OF THE SPECTRUM?

I enjoy your thought-provoking editorials, but only recently did I get around to reading "The EMF Uproar" in your July 8 issue. You elevate the mechanics of the debate considerably by publishing Lubitz' and Holbrook's energetics for all to see.

I am not one of the nuts who thinks we should close power plants or bury all the wires, but my BS detector always buzzes when I see someone wield a narrow piece of math to dismiss a broad and heartfelt human question. I'm glad we don't have to worry about 60-Hz magnetic effects, but there are other, more highly energetic mechanisms to consider.

If, while struggling to receive your favorite AM station on a dark, damp night, you were to look at the corona discharges escaping from a nearby high-voltage power line, you would observe that power lines emit energy in obviously detectable ways not only at 60 Hz, but throughout the broadcast band, and in the visible-light spectrum, and probably beyond.

To make a rough determination of just how far beyond "visible" the emitted spectrum extends, consider how much energy an electron would have if it were accelerated through the potential difference available between the power line and ground. If the power line swings to 100 kV, as many do, an electron could receive up to 100 keV. I gladly accept the view that the 60-Hz magnetic component is innocuous. I hope Mr. Lubitz and Dr. Holbrook would agree that an errant 100-keV particle or photon is quite capable of rupturing a molecular bond. A 100-keV photon is "ionizing radiation" in anyone's book.

I would propose that Friends of Learning Inc. and Eurotechnical Research University Ltd. pick up the inquiry afresh and let us know what they think about the rest of the spectrum.

DOUGLAS W. RAYMOND
ORINDA, CALIF.

RESEARCH AT THE LOCAL LIBRARY

Some months ago, my sister asked me if she should be concerned about EMF in her newborn daughter's bedroom, since the power line service drop was on the outside of that room. Despite being an EE for 15 years, I, too, found myself a lay person when it comes to the effects of electromagnetic energy on the human body.

I did some research at the local public library and found that the concern over 60-Hz EMF is not new and, while the popular press has grabbed on to this in just the last few years, there has actually been a fair amount written on the subject over the last 20 years. Some books on the subject (these books reference many technical papers on the subject):

- Biological Effects of Power Frequency Electric and Magnetic Fields, congress of U.S. Office of Technology Assessment, background paper (1987).

- Currents of Death, by Paul Brodeur (1989).

- Cross Currents, The Promise of

WIRELESS
SYMPOSIUM
EXHIBITION

FEBRUARY 15 - 18, 1994
SANTA CLARA CONVENTION CENTER

The Wireless Symposium & Exhibition is your single best oppurtunity to make the connections that will help you compete in today's marketplace.

This is your one-stop opportunity to see all the newest products...uncover innovative solutions to your current problems...explore the latest hardware and software business solutions ...and learn more about the techniques and the technologies that drive the applications in the exploding market of wireless technology.

The Road Continues In Santa Clara!

The second annual Wireless Symposium & Exposition, February 14-18, 1994 at the Santa Clara Convention Center will feature four days of technical presentations and tutorials, along with four high-powered technical workshops focusing on the newest developments and latest advances in design and test solutions for most wireless applications.

CALL TODAY!

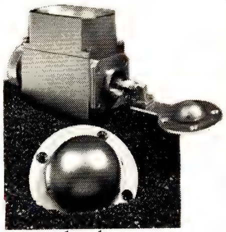
For more information call Mary Begley at (201) 393 - 6289.

Sponsored by *Microwaves & RF,* and *Electronic Design* magazines.

EXPERIENCE A WORLD OF WIRELESS OPPORTUNITIES

CIRCLE 345 FOR U.S. RESPONSE   CIRCLE 346 FOR RESPONSE OUTSIDE THE U.S.

MELOPEE-LIGHTNING
HPR



MEASURE UP A STORM !

Our Melopee-Lightning HPR instrumentation line is the only high precision active sensor measurement line in the world designed for analysis of lightning and its associated effects.
It permits measurements on civil or military aircraft, trains and automobiles, telephone exchanges and telecommunication systems, overhead or railway infrastructures, etc.
In addition to a link processor, the Melopee-Lightning line includes dedicated sensors characterized by immunity to even strong outside fields, associated with very high sensitivity and extreme miniaturization.

Characteristics:
- E field ranges : ±30 V/m to ±2 MV/m (depending on sensor)
- H Field ranges : ±1 A/m to ±53 kA/m (depending on sensor)
- Voltage ranges : ±500 μV to ± 10kV
- Current ranges : ±150 mA to ±200 kA (depending on sensor)
- Bandwidth : 45 or 130 MHz (depending on sensor)
- Parasitic rejection : 40 dB
- Amplitude precision : 0.25 dB
- Range dispersion : ±0.2 dB

THOMSON-CSF
ELECTRONIC SYSTEMS DIVISION

Electromagnetic and Nuclear Department
9, rue des Mathurins - BP 150 -
92223 Bagneux Cedex - France
Tel. (33-1) 49 85 38 26
Fax. (33-1) 49 85 38 43

PEMA 2B

CIRCLE 226 FOR U.S. RESPONSE
CIRCLE 227 FOR RESPONSE OUTSIDE THE U.S.

CLASSIFIEDS

BUSINESS SERVICES

ADVANCED TEST EQUIPMENT
Rents, Sells, & Services electronic test & measurement equipment.
For more information or a sales brochure call:
800/404-ATEC ext. 101

WHY WAIT?
Penton Classifieds now accepts MasterCard and Visa for prepayment of your Classified Ad!
For more information contact Lois Walsh at:
696-7000 ext. 2359
MasterCard
VISA

Looking for
"leading edge" engineers ?
165,090
Electronic Engineers and Engineering Managers read
ELECTRONIC DESIGN
twice monthly.
To reach them with a recruitment ad in this section call:
Lois Walsh at
Penton Classifieds
(216) 696-7000
ext. 2359
FAX 216-696-8207

READERS' COMMENTS

Electromedicine, The Perils of Electropollution, by Robert O. Becker, M.D. (1990).

- Warning: The Electricity Around You May Be Hazardous To Your Health, by Ellen Sugarman (1992).

The electrical power industry has always downplayed the possibility of a link between 60-Hz fields and human health, claiming there are no thermal effects even from strong 60-Hz fields (unlike microwaves). Hence, there can be no damage to cells.

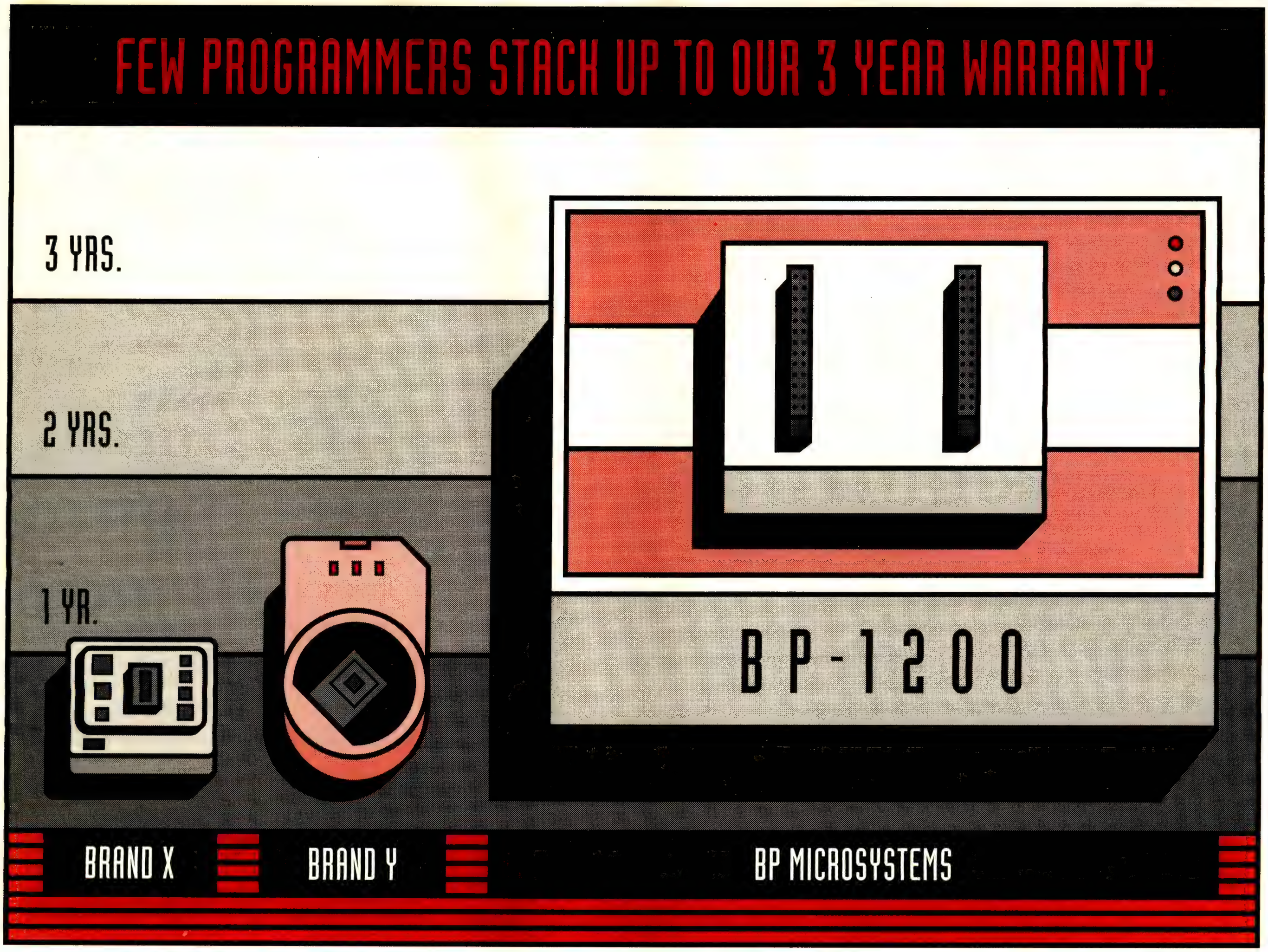
Unfortunately, this logic presumes science knows all there is to know about cell biology. Despite hundreds of textbooks and thousands of papers on the subject, we really don't know much about the fundamental forces of life.

How do cells "know" when to divide or when to stop? How do embryo cells "know" when to differentiate into blood cells, bone cells, brain cells, etc.? What causes a particular cell to become cancerous? We don't know the answers to these kinds of questions, but we do know that it doesn't require energy high enough to break molecular bonds (as Dr. Holbrook's calculations seem to suggest).

As EEs, we should be concerned about EMF as a potential occupational hazard. Besides 60-Hz danger, there is evidence male engineers and technicians subject to RF energy incur an increase in the number of female offspring and an overall decrease in fertility. As professionals, we have a responsibility to apply scientific knowledge for the benefit of society. The U.S. Environmental Protection Agency has recommended "prudent avoidance," but this message does not seem to be getting through to EEs.

Many EMF hazards could be easily and inexpensively reduced through proper design, but most EEs, like myself, have been ignorant of any need to bother with such considerations. I hope magazines such as Electronic Design continue to bring such issues to the forefront.

TIMOTHY CURRANT
RAMSEY, MINN.


FEW PROGRAMMERS STACK UP TO OUR 3 YEAR WARRANTY.
3 YRS.
2 YRS.
1 YR.
BP-1200
BRAND X
BRAND Y
BP MICROSYSTEMS

All device programmers were not created equal. Some are simply better than the others.

The BP-1200, with the fastest programming times in the industry and superior device coverage, stands heads and shoulders above the competition. And the BP-1200's three year limited warranty* casts a big shadow over the one year warranties offered by our competitors. Only the better product comes with the better warranty.

We are so confident about the reliability of the BP-1200 that we promise to send you a free loaner unit, shipped via next day air, if your BP-1200 should break during your first year of ownership.*

The BP-1200 supports virtually all programmable devices, with continuously expanding device coverage, giving you the freedom to use all the latest devices to optimize your designs. Field-upgradable to grow with your needs, the BP-1200 supports all device technologies up to 240 pins. Ease-of-use, high yields, and high speed combine with our direct-dock autohandler interface to make the BP-1200 the ideal choice for production.

Best of all, the BP-1200's outstanding performance and dependability can be yours for a very reasonable price. Call today for complete product information and a demonstration disk.

BP MICROSYSTEMS

BP Microsystems, Inc. • Houston, TX

1-800-225-2105

© 1993 BP Microsystems, Inc. All Rights Reserved. *Available only on units sold in the U.S. after September 15, 1993. Features and specifications subject to change without notice. Certain restrictions and exclusions apply. For further details on our limited warranty, contact the BP Microsystems Customer Support Center.

CIRCLE 343 FOR U.S. RESPONSE **CIRCLE 344 FOR RESPONSE OUTSIDE THE U.S.**

ENGINEERS......

Attend 2 Major Motion Contr

November 2,3,4 1993
Lawrence Convention Center
Pittsburgh, Pennsylvania

HYDRAULICS & PNEUMATICS SHOW:

View the latest in hydraulic and pneumatic components, systems, controls, and materials. Meet with exhibiting company engineers and explore new applications and advanced designs. Plus, attend the following functions and increase your knowledge of state-of-the-art fluid power systems:

- ▲ The Electrohydraulics/Electropneumatics Seminar: reviewing the integration of electronics with fluid power systems including control objectives and strategies. The four sessions will cover: 1.Tranducers 2.Signal Routing 3.Controls 4.Control Concepts.
  Fees to attend all four seminars will be $95.00. Registration will also be accepted for individual seminars at $30.00 each.
- ▲ Software Symposium: Companies exhibiting at the show will conduct brief demonstrations of their software to illustrate its capabilities. The symposium is open and free to all show attendees.
- ▲ Fluid Power Certification Exams: Hydraulic Technician, Pneumatic Technician, and Fluid Power Specialist exams will be held. This arrangement will provide the convenience of attending the review session, taking the exam, and attending the show in the same building.

NOVEMBER 2-4, 1993 • LAWRENCE CONVENTION CENTER • PITTSBURGH, PENNSYLVANIA

Avoid the registration lines at the Show and save $20.00 by filling out the adjacent pre-registration form on or before October 15, 1993.

Mail To:
H&P Show/PT Design Show
Penton Publishing
1100 Superior Avenue
Cleveland, OH 44114
(216) 696-7000
Fax To:
(216) 696-7648

After October 15, plan to register on-site and pay $20.00.

FREE PRE-REGISTRATION

Bring your key personnel to the H&P Show/ PT Design Show on November 2-4 at the Lawrence Convention Center in Pittsburgh, Pennsylvania
(Pre-register them by photocopying this form.)

Industry Events Of 1993 ...
More than 200 companies will exhibit

POWER TRANSMISSION DESIGN SHOW:

As a PT Design Show attendee, you will meet sales and application engineers; see the latest in innovative system designs, improved componentry, and advanced controls; gain insight and assistance in developing new and better applications and system designs.

Take ADVANTAGE of the following high-caliber technical seminars offered during the first 2 days of the show sponsored by Power Transmission Design Magazine:

- ▲ Fuzzy Logic, expert systems, and neural networks...the roles they play in motion control.
- ▲ Using failure analysis to solve reliability problems.
- ▲ Getting the most from fully digital-regulated adjustable speed drives.
- ▲ Understanding BLDC servo, vector servo, brush-type dc servo, step motor drives, and how to select the best for the application.

Fees to attend all four seminars will be $95.00. Registration will also be accepted for individual seminars at $30.00 each.

NOVEMBER 2-4, 1993 • LAWRENCE CONVENTION CENTER • PITTSBURGH, PENNSYLVANIA

1. H&P Show/PT Design Show Pre-Registration Form

First Name ____________ Last Name ____________

Title ____________

Company Name ____________

Address ____________

City ____________ State ____________ Zip ____________

Phone Number ____________ Fax ____________

○ Send more information on Electrohydraulic/Pneumatic Seminar

○ Send more information on PT Motion Control Seminar

* *For exhibitor information, contact Tobi Goldoftas, Show Director X2437*

2. Job Titles

○ Sales
○ Purchasing
○ Management
○ Plant Engr. & Maint.
○ Prod. & Equip. Design/ Research & Eng.
○ Other

1 Badge good for 2 shows

Mail To:
H&P Show/PT Design Show
Penton Publishing
1100 Superior Avenue
Cleveland, OH 44114
(216) 696-7000

"ED"

“Without advertising, everybody would think Ronald was just the name of a former president.”

Mike Quinlan, Chairman, CEO McDonald's (left)

“The remarkable thing is, when you think about McDonald's® you've got to think about people. A friendly crew person welcoming you. Kids, moms and dads having a good time at McDonald's, even a funny clown named Ronald® Those pictures in your mind are advertising at work.

Our advertising is people to people—an invitation from our people to our customers to come in and visit. Personal, friendly, and above all, real.

I'm told there are business people out there who don't believe in the power of advertising. For them, two facts: First, McDonald's is one of the most advertised brands on this planet. Second, McDonald's is the only company listed in the current Standard and Poor's 500 to report combined increases in revenues, income, and earnings per share for more than 100 consecutive quarters since 1965.

Frankly, Ronald and I like to think there's a connection here.”

AAAA
American Association of Advertising Agencies

If you would like to learn more about the power of advertising, please write to Department D, AAAA, 666 Third Avenue, New York, New York 10017, enclosing a check for five dollars. You will receive our booklet *It Works! How Investment Spending in Advertising Pays Off.* Please allow 4 to 6 weeks for delivery. This advertisement prepared by Leo Burnett Co., Inc.

"Increasing our ad budget was so successful, our agency recommended we cut it."

Photo: Frank Moscati

See what it's like to live 7 days without tranquilizers.
True, Columbus paid less than $945 getting to the Caribbean, but he had to take the Nina, the Pinta and the Santa Maria.
Sometimes you just gotta stop and smell the saltwater.
If you've never been early for anything in your life, it's probably because nobody made it worth your while.
With prices like these, you'd probably expect to row.
The last time the launching of a ship got this much attention it rained for 40 days and 40 nights.
The only thing standing between you and our cruise to Bermuda is $695 and an occasional pothole.
Unlike the IRS
Once a year the swallows fly to Capistrano. The salmon swim to their spawning ground. And Bondians cruise to Bermuda.
It's like Monty Hall putting the big deal behind all three doors.
Sure, you could crawl in a hole and hide. But wouldn't our bright spacious cabins be more comfortable?

Al Wallack, Sr. VP Marketing, Celebrity Cruises, after returning from having his hearing checked.

"A great time to introduce a new luxury cruise line. The economy was in a slump, and the competition was on the rise.

We told our new advertising agency we have to go in with all guns blazing. And gave them the extra money to do it.

They recommended a three phase campaign. Phase 1. Full page newspaper. One ad a week for 24 weeks and one-third pages in the travel section. Phase 2, radio. Then 3, television to sweep up one season and sow the seeds for the next.

To make a long story short, two-thirds into the newspaper phase, Celebrity's ships were just about full to the end of the season. With so little left to sell, we all agreed to hold the radio and TV and save the remainder of the budget.

In roughly two years Celebrity became the number one cruise line from New York to Bermuda.

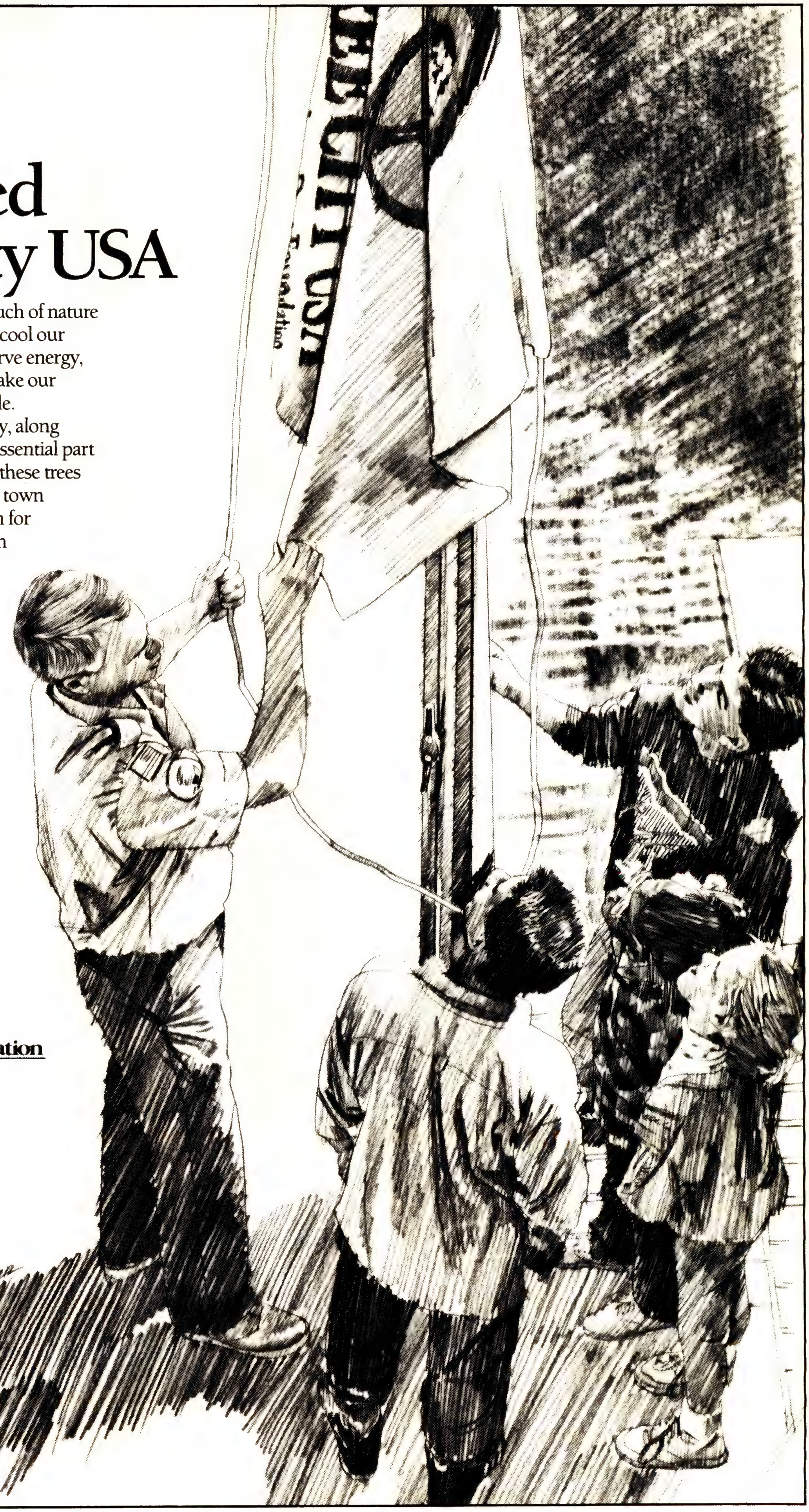
We've just added another new luxury ship and we're anxious to fill it. So once again we've upped our budget. So far, our agency hasn't tried to talk us out of it."

AAAA

American Association of Advertising Agencies

If you would like to learn more about the power of advertising, please write to Department D, AAAA, 666 Third Avenue, New York, NY 10017 enclosing a check for five dollars. You will receive our booklet, *It Works! How Investment Spending In Advertising Pays Off.* Please allow 4 to 6 weeks for delivery.

This advertisement prepared by Korey, Kay & Partners, New York.



You Need Tree City USA

City trees add the soft touch of nature to our busy lives. They cool our cities, fight pollution, conserve energy, give wildlife a home, and make our neighborhoods more liveable.

The trees on city property, along streets and in parks, are an essential part of the urban forest. To keep these trees healthy and abundant, your town needs an organized program for their care . . . an annual action plan to plant and prune the city's trees, and to maintain their health.

You can make a difference — by planting and caring for trees in your yard and in your neighborhood, and by encouraging your city government's community forestry program.

Support Tree City USA where you live. For your free booklet, write:
Tree City USA, The National Arbor Day Foundation, Nebraska City, NE 68410.

The National Arbor Day Foundation

ELECTRONIC DESIGN

DIRECT CONNECTION ADS

Products/Services Presented By The Manufacturer.

To Advertise, Call KIMBERLY STANGER At 201/393-6080

PROTO EXPRESS

Best Value in the World
for
POLYIMIDE & FR4
1 to 5 DAY TURN
1 to 12 Layers
PRINTED CIRCUIT PROTOTYPES

2 PIECE PRICES FOR FR4 .062 Th.

LAYERS		1	2	3&4	5&6	7&8
SQUARE INCH UP TO	15	$233	$292	$639	$787	$935
	30	264	330	724	891	1059
	60	311	389	853	1049	1137
	90	358	448	980	1207	1434
	120	385	486	1044	1311	1559

- 5 PIECES x 1.34
- 10 PIECES x 1.67
- 5 DAY PRICES ABOVE
- UL LISTED

EXTRAS

- Photo Plotting
- Testing
- Gold Contacts - $50
- 25% - Below 8 Mil Hole
  - Below 15 Mil Hole
- SMOBC & LPI - $50

CAPABILITIES

- Buried & Blind Vias
- Polyimide Multilayer
- Full Body Gold
- Carbon Paste
- Tin nickel burn-in boards
- SMT-SMOBC
- Up to 22 layers
- Impedance control boards

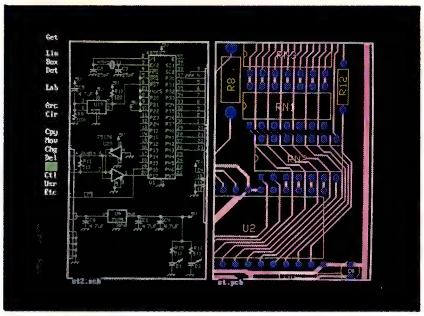
DISCOUNTS

- VISA MasterCard 5%
- COD 10%

FOR MORE INFORMATION CALL OR FAX

Ken Bahl ■ 1108 W. Evelyn Ave., Sunnyvale, CA 94086
Phone (408) 735-7137 FAX (408) 735-1408 Modem (408) 735-9842

PROTO EXPRESS **CIRCLE 400**



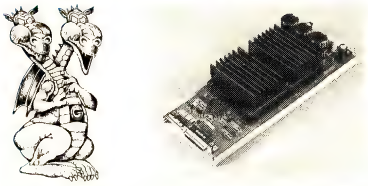
NEW SCHEMATIC AND PCB SOFTWARE

With support for extended and expanded memory, HiWIRE II can handle your most demanding schematic and PCB designs quickly and easily. The unique HiWIRE editor allows you to display and edit schematics and PCBs simultaneously, using the same commands for each. HiWIRE II is $995, and is guaranteed.

WINTEK CORPORATION,
1801 South Street, Lafayette, IN 47904
(800) 742-6809 or (317) 448-1903

WINTEK CORPORATION **CIRCLE 401**

DRAGON DRIVERS
for STEPPING MOTORS
TWO FOR ONE SALE

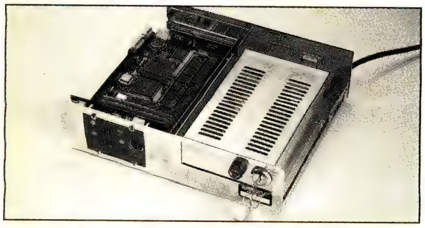


General Controls Electronics, Inc., new 29ALPT dual axis Dragon Driver provides dual axis 2" or 3" motor control for the price of most single axis comparable models. The 29ALPT is a dual 40v, 3 amp/stepper motor driver built on a single P.C. board. The 29ALPT can be connected to a standard personal computer parallel port to provide dual axis motion. Individual board prices start at $499.00 and complete system prices start at $999.00, which includes motors and everything else for immediate set up.

GENERAL CONTROLS ELECTRONICS, INC
2350 Brickvale Drive, Elk Grove Village, IL 60007
PLEASE CALL (708) 595-2152 OR
FAX (708) 595-2271

GENERAL CONTROLS ELECTRONICS, INC. **CIRCLE 402**

REMOTE DISKLESS PC

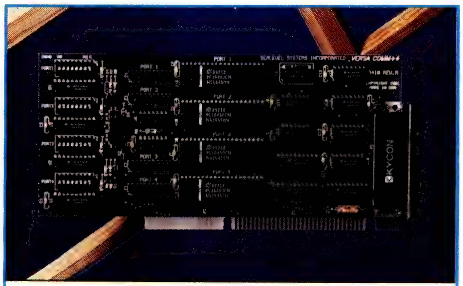


COMPLETE INDUSTRIAL PC WITH A PASSIVE BACKPLANE 286 OR 386 CPU WITH SSD AC OR DC INPUT POWER, RS232 & RS422/485 PORTS.

SIZE 10.5"W x 8.375" x 2.75"H

TRANSDUCTION LIMITED
5155 Spectrum Way, Bldg. 23
MISSISSAUGA, Ontario
L4W 5A1
Tel: 416-6251907, Fax: 416-625-0531

TRANSDUCTION **CIRCLE 403**



COMMUNICATIONS & I/O SPECIALISTS

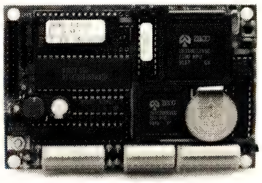
- 1, 2, 4 & 8 Port RS-232/422/485
- Windows 3.X Compatible
- RS-530 & V.35 Interface
- Digital & Relay I/O
- Laptop Add-Ons
- Excellent Technical Support
- Current Loop
- High Speed Sync/Async
- Micro Channel™

SEALEVEL COMMUNICATIONS & I/O

SEALEVEL SYSTEMS INC.
PO Box 830
Liberty, SC 29657
803-843-4343

SEALEVEL SYSTEMS INC. **CIRCLE 404**

NEW! Little PLC™ *$195*



Program It In C

Our new **Little PLC™** measures only 4.33 x 2.85 inches and can mount on standard DIN rail. This miniature controller costs only $195, including 8 optically isolated inputs and 8 relay driver outputs. Low cost expansion cards allow you to add more inputs and outputs: digital and analog. It has dual RS-485 serial I/O, battery backed memory and time/date clock, programmable timers and a watchdog. Our easy to use and affordable **Dynamic C™** integrated development system also costs $195. You can write simple programs in an hour, or you can develop major applications with 20,000 lines of C language.

Z-World Engineering
1724 Picasso Ave., Davis, CA 95616
(916) 757-3737 Fax: (916) 753-5141
24 hr. Automatic Fax: (916) 753-0618
(Call from **your fax**, request catalog #18)

SEE US AT E.S.C. — BOOTH 812 **CIRCLE 405**

RELIABILITY PREDICTION SOFTWARE

ARE YOUR PRODUCTS RELIABLE?

The RelCalc 2 Software Package automates the reliability prediction procedure of MIL-HDBK-217, or Bellcore, allowing quick and easy reliability analysis of electronic products on your PC. Say goodbye to tedious, time consuming, and error prone manual methods!

- NEW UPDATE! VERSION 3.1 now available.
- User friendly: pop-up menus, hypertext help.
- Very easy to learn and use; quick data entry.
- Part library for rapid recall of part data.
- Global editing functions for what-if? trials.
- Reports which clearly organize results.
- Save time & money as you design for quality.
- Try our Demo Package today for $25.

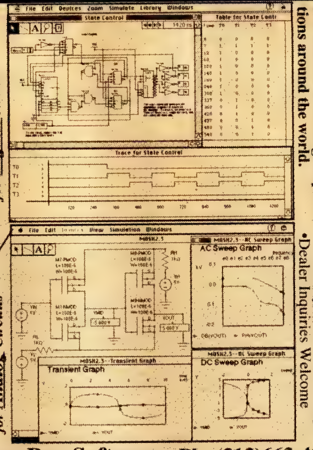
T-Cubed Systems, 31220 La Baya Drive,
Suite 110, Westlake Village, CA 91362
CALL: (818) 991-0057 FAX: (818) 991-1281

T-CUBED SYSTEMS CIRCLE 406

Analog & (NEW RELEASE) Digital Circuit Design & Simulation
for the Macintosh & PC with Windows

B² Logic® v.3.0 NEW *for Digital Circuits*

B² Spice® *for Analog Circuits*



Now in use at over 60 major universities & leading corporations around the world.

- •Product prices start at **$149.00**
- •University & Student Pricing
- •Dealer Inquiries Welcome

Beige Bag Software Ph.:(313)663-4309
Fax: (313) 663-0725 • 715 Barclay Ct. Ann Arbor, MI 48105
(VISA/MC Accepted)

BEIGE BAG SOFTWARE CIRCLE 407

ELECTRONIC DESIGN

DIRECT CONNECTION ADS

1993 Ad Schedule

Issue Date:	Ad Close
May 3	4/2/93
May 13	4/16/93
May 27	4/30/93
June 10	5/14/93
June 24	5/28/93
July 8	6/11/93
July 22	6/25/93
August 5	7/9/93
August 19	7/23/93
September 2	8/6/93
September 16	8/20/93
October 1	9/3/93
October 14	9/17/93
November 1	10/8/93
November 11	10/15/93
November 22	10/29/93
December 2	11/5/93
December 16	11/19/93

To Reserve Space Call:

Kimberly Stanger

201-393-6080

FREE!
120 Page Catalog

"Optics for Industry"

ROLYN OPTICS supplies all types of "Off-the-Shelf" optical components. Lenses, prisms, mirrors, irises, microscope objectives & eyepieces plus hundreds of others. All from stock. Rolyn also supplies custom products & coatings in prototype or production quantities. Write or call for our free 120 page catalog describing products & listing off-the-shelf prices. **ROLYN OPTICS CO.**, 706 Arrowgrand Circle, Covina, CA 91722, (818) 915-5707 & (818) 915-5717.
FAX: (818) 915-1379.

ROLYN OPTICS CIRCLE 408

PROTO SOURCE

QTY -2- Pricing -- Square Inches up to

#LYRS	16 Sq	32 In	64 Sq	96 In	120
1	187	214	253	286	308
2	236 $	264	313	363 $	390
3-4	511	583	682	786	836
5-6	632	720	841	968	962
7-8	748	869	913	1149	1248

Prices Are For 10 Day Turn FR-4 .062

DISCOUNTS

-10 % COD -6 % Master/Visa

ADDERS

- ☐ X-1.35 For Qty-5 X-1.67 For Qty-10
- ☐ X-1.25 For < 8 MIL or < .20 Drill
- ☐ X-1.15 For 5 Day Turn
- ☐ SMOBC - $50 Gold Tabs - $50

For More Information Call
Modem BBS @.... 612-425-4101
Neil or Barry @.... 612-425-5370

FAX ON Demand
Call From Your Fax Phone
612-425-5470
For Complete
INFO-KIT!

TECHNOLOGY CONGRESS CIRCLE 409

See For Yourself

Reliability Prediction Program

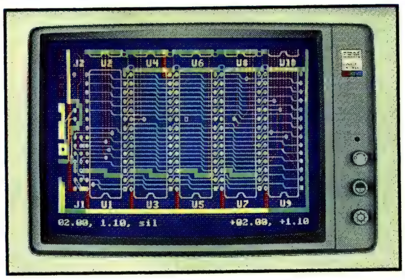
The **Reliability Prediction Program** (RPP) performs quick and easy reliability prediction analyses in accordance with the parts count and part stress methods of the industry standard MIL-HDBK-217.

The **Logistic Support Analysis Record** (LSAR) transfer feature pulls data from PSI programs for transfer into MIL-STD-1388-2A and 2B formats. This allows DOD validated LSA software to directly read the LSAR files.

Call for your FREE Demo Package

PSI POWERTRONIC SYSTEMS, INC.
13700 Chef Menteur Hwy.
New Orleans, LA 70129
504-254-0383 · FAX 504-254-0393

POWERTRONIC SYSTEMS, INC. CIRCLE 410



PCB SOFTWARE FOR THE IBM PC

With smARTWORK create double-sided printed-circuit-boards in a fraction of the time hand taping requires. It features continual design-rule checking, automatic pad shaving, and text for all three layers. smARTWORK with auto-routing is $895 (without $495) and comes with 30-day money-back guarantee. Credit cards welcome.

Wintek Corp.
1801 South St., Lafayette, IN 47904
(800) 742-6809 or (317) 448-1903

WINTEK CORPORATION CIRCLE 411

YOUR AD HERE

Here's all you have to do:

- Send a B/W or 4C glossy photo.
- Include 13 lines of copy. (37 characters per line)
- Write a headline of 32 characters or less.

We do all the rest.
No production charges.

We also accept camera-ready art.
Ad size 2$^3/_{16}$″ wide × 3″ deep.

MIL-STD 1553/1760 Monolithic Interface

NHI 1556RT . . .
FLIGHT PROVEN REMOTE TERMINAL FOR INTERFACING ANY SUBSYSTEM TO THE 1553/1760 BUS

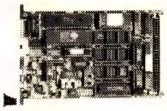
- 69 Pin 1.1"Sq. PGA & 68 Pin 0.95"Sq. Flat Pack
- 4K Words Internal Memory
- Can Use With Sinusoidal/Trapezoidal Transceivers
- Message Illegalization Without Prom
- Supports Notices I & II
- Programable Interrupts Stored In Internal FIFO
- Internal 32 Bit Time Tag Clock
- Broadcast Flag for Each Message

NHi
National Hybrid, Inc.
2200 Smithtown Ave, Ronkonkoma, NY 11779
(516) 981-2400 FAX: 516-981-2445

NATIONAL HYBRID, INC. CIRCLE 413

SMART VOICE CARDS

A family of intelligent digital audio cards for **stand-alone** and industrial bus use. The following buses are supported:



MA550 VMEbus card

VME, STD, STE and G-64

- Tape recorder quality, 10kHz audio BW.
- MA592 only – PCM/ADPCM 3.4kHz BW.
- On-board µP with real-time multitasking control software for sound processing, communications and control functions.
- Serial, I2C bus and parallel I/O.
- Watchdog timer and transient protection to ensure reliable operation.

Supplying voice cards to industry since 1984.

Microcontrol (Australia) Pty Ltd
PO Box 1020, Pymble
NSW 2073, Australia
Fax: +61-2-488-7719

MICROCONTROL (AUSTRALIA) PTY LTD CIRCLE 414

C COMPILERS
MACRO CROSS ASSEMBLERS
HIGH LEVEL SIMULATOR/DEBUGGERS

Price of C Compiler Includes: Macro Cross Assembler, Linker, Librarian, High Level Simulator/Debugger and Object Libraries.

Prices (most versions):

Macro Cross Assembler – $250.00
Simulator/Debugger – $250.00
C Compiler – $650.00

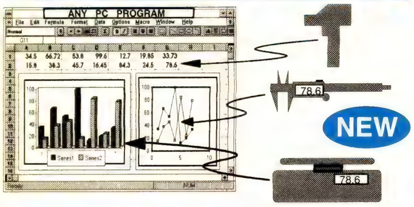
1 800 843-8144

One-year money-back guarantee and unlimited technical support included in price.

2500AD SOFTWARE INC
109 Brookdale Avenue
Buena Vista, CO 81211
(719) 395-8683 Phone (719) 395-8206 Fax

2500 AD SOFTWARE INC. CIRCLE 415

RS232 Direct Into Any PC Program



Read Real-Time Data from Any Serial Device into Any Application - Lotus, dBASE, Excel, etc. Full 2-way I/O with many advanced features.
No Hardware or Programming Required!

The Software Wedge™
The Ultimate Data Acquisition Solution

For **Free** Literature Call
800-722-6004
DOS ver.4.0 $129, *Windows* ver. $199

TAL
T.A.L. ENTERPRISES
2022 Wallace St., Philadelphia, PA 19130
Tel. (215) 763-2620 Fax. (215) 763-9711

T.A.L. ENTERPRISES CIRCLE 416

SMALLEST +5V Monolithic Transceivers

NHI 1567 SERIES

MIL-STD 1553/1760
Dual In-Line & Flatpack Transceivers (.300 x 1.000) Meet Your Tightest Board Space Requirements

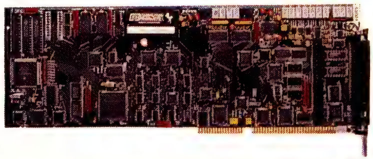
- Perfect For New Systems & Upgrades
- Form, Fit & Function Replacements For All Packages And Configurations
- Custom Packaging Available
- MIL-STD 1772 Certified And Qualified Automated Assembly Line To Meet Your Quality & Quantity Needs
- Ship From Stock Or "Scheduled On Time" Deliveries

NHi
National Hybrid, Inc.
2200 Smithtown Ave, Ronkonkoma, NY 11779
(516) 981-2400 FAX: 516-981-2445

NATIONAL HYBRID, INC. CIRCLE 417

INTELLIGENT DATA ACQUISITION

NEW



Microstar Laboratories new e Series Data Acquisition Processors™ have on-board intelligence: a real-time software environment for quick development and fast operation. They run under DOS, Windows, or OS/2. Learn about this new hardware and software solution from a leader in the field. Free color catalog includes an easy-to-use approach to DSP.

Call now — 206-453-2345

Microstar Laboratories, Inc.
2265 116th Avenue NE
Bellevue, WA 98004
Tel (206) 453-2345
Fax (206) 453-3199

MICROSTAR LABORATORIES

MICROSTAR LABORATORIES CIRCLE 418

Relex Reliability Software

. . . "the intuitive solution"

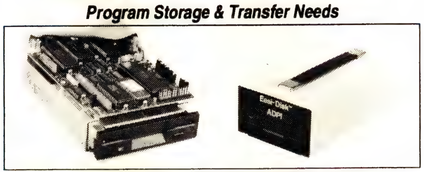
- ★ MIL-HDBK-217
- ★ Bellcore
- ★ Mechanical
- ★ FMEA, FMECA
- ★ Maintainability
- ★ Parts Count, more ...

Call 410-788-9000 Today for Information and a Self-Running Demo Disk on this Integrated and Highly Acclaimed Set of Software Tools!

INNOVATIVE SOFTWARE DESIGNS, INC.
Two English Elm Court · Baltimore, MD 21228
410-788-9000 · FAX 410-788-9001

INNOVATIVE SOFTWARE DESIGNS, INC. CIRCLE 419

RS-232/GPIB-488 Solutions for Instrumentation Program Storage & Transfer Needs



The Easi-Disk Simplifies Your Data Acquisition Transfer, and Retrieval Needs Completely.

- IBM/MS-DOS PC Compatible
- RS-232, GPIB-488, 8-Bit Parallel, RS-485, RS-422, plus.
- Host or Manual Controls
- Remote Polling
- 3½" and 5¼" Floppy Disks or Removable RAM
- Stand-Alone, Rackmount or "Built-In" OEM
- 110VAC, 220VAC, 6VDC, 12VDC, or Battery Operation
- Stand-Alone Price is $795, Controller Card Price is $495, in Singles with Quantity Discounts

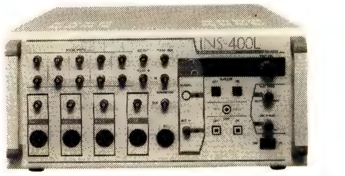
Also, ADPI offers ONE FOR ALL Tape Backup System Featuring 160 Meg & 1.2 Gig of Storage for Multiple PC & Network Backup on MS-DOS, Macintosh, SCO-UNIX, OS/2, PICK, Peer to Peer LANs, and Novel LANs.

ANALOG & DIGITAL PERIPHERALS, INC.
ADPI
P.O. BOX 499
TROY, OHIO 45373
PHONE: 513/339-2241
FAX: 513/339-0070

ANALOG & DIGITAL PERPHERALS CIRCLE 420

NoiseKen

IMPULSE NOISE SIMULATOR

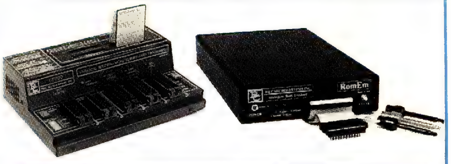


MODEL INS-400L

Square wave pulses with 1ns rise times for more realistic simulator.

U.S.A. WATAHAN NOHARA INTERNATIONAL, INC.
TEL(800)366-3515

NOISE LABORATORY CIRCLE 421



RS232 EE/EPROM, MICRO & MEMORY CARD PROGRAMMER $395

- **Programs EE/EProms, Flash Eproms, ZPRams, Intel Micros, Memory Cards.**
- **Stand-Alone Mode** for EE/EProms and Memory Card Duplication/Verify.
- All 24/28/32 pin EE/EProms to 8 MBits (upgradeable to 32 Megabits). Micros:8741/A,-2/A,-4,-8,-9,-51,-C51,-C51FA/B,-52,-53,-55,-C521,-C541,9761.
- Accepts dedicated modules: **Memory Card Programming Module** (Seiko/Epson) - $145, **Eraser/Timer Module** - $50, **Gang Module** (4 sockets) - $145.
- Can be operated with any computer containing an **RS-232 serial port**.
- **User friendly Menu-Driven Interface Program for IBM-PC** or compatible.
- **Full 1 year warranty**. Customer support via voice line, fax or dedicated BBS.

INTELLIGENT ROM EMULATOR $395

- Emulates **2716** through **27512** EProms with a single unit. **Access time 120ns**.
- Connects to the **standard parallel printer port** via a standard printer cable.
- User friendly software. Command set includes: **Load**(data), **Write**(data), **Display**(memory), **Type**(of EProm), **Edit**(memory), **Fill**(memory), **Calculator**, **Reset**(target system), **Activate**(debugging feature), **Monitor**(selected feature).
- **Address Compare with Halt output, Address Snapshot, Trigger input**.
- **Fast data loading via parallel printer port (64k bytes in less than 10 sec)**.
- **Cascadable up to 8 units**. Includes target cable with Trigger/Reset/Halt clips.
- CMOS RAM chips with rechargeable NiCad battery backup.
- **1/2/4/8 MB Emulators** also available from $395.

MC/VISA/AMEX *All prices are U.S. list only.*

B&C MICROSYSTEMS INC.
750 N. PASTORIA AVE., SUNNYVALE, CA 94086 USA
Tel: (408) 730-5511 Fax: (408) 730-5521

B&C MICROSYSTEMS **CIRCLE 422**

DC/CAD

introducing...

THE TERMINATOR

Super High Density Router
(Complete with Schematic & PCB EDITOR)

Features the following powerful algorithm & capability:

- Rip - up and Retry
- Pre-routing of SMT components
- Real-Time via minimization
- Real-Time clean up passes
- User defined strategies
- Window 3.0 capability as DOS Task
- 1-mil Autoplacer and Autopanning
- Two-way Gerber and DXF
- Automatic Ground Plane w/ Cross-Hatching
- Complete w/ Schematic & Dolly Libraries
- Optional simulation capability & enhanced mode for 386 users

CALL FOR A FREE DEMO
Price Range: $ 195 - $ 2500
*Special promotional offer is currently available

* PCB LAYOUT SERVICE AT LOW COST *

LEASE PROGRAM & SITE LICENSE AVAILABLE

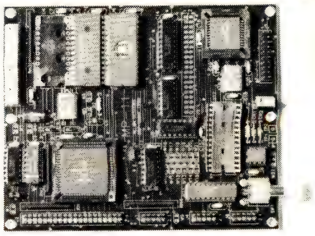
Design
Computation

1771 State Highway 34
Farmingdale, NJ 07727
(908) 681 - 7700 • (908) 681 - 8733 (FAX)

" DC/CAD . . . The performance value leader for the demanding entrepreneur "

DESIGN COMPUTATION **CIRCLE 423**

8051, 8096, 68HC11, 68332 SINGLE BOARD COMPUTERS



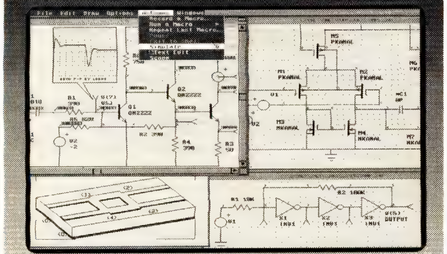
We feature a series of single board computers for process control applications. Each is available as a bare printed circuit board, or fully assembled and tested. Optional development software is also available. Please contact us to discuss your requirements and receive a literature package covering technical specs and pricing.

ALLEN SYSTEMS
2346 Brandon Road, Columbus, OH 43221
614-488-7122

ALLEN SYSTEMS **CIRCLE 424**

Analog Circuit Simulation

ICAP/4 - SPICE THAT'S EASY TO USE



- **Schematic Entry**
- **IsSpice3 Simulator**
- **Model Libraries**
- **Waveform Graphics**

Intusoft - Power at an Affordable Price!

The ICAP/4 system allows an engineer to enter a mixed analog/digital circuit into the computer and evaluate its behavior before actually building the circuit. ICAP/4 includes schematic entry, extensive Spice model libraries, an advanced Spice 3F based simulator, and graphics post processing. Complete systems are available for under $1800.

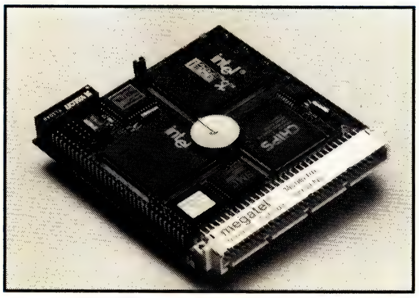
Call Or Write For Your Free Demo and Information Kit!

intusoft

P.O. Box 710 San Pedro,
CA 90733-0710

Tel. 310-833-0710 ***Fax 310-833-9658***

INTUSOFT **CIRCLE 425**



Embedded PC

Megatel Introduces On-board Super VGA & Ethernet

- 386SL™ CPU at 16MHz
- Up to 16MB User DRAM
- On-board Super VGA/LCD, SCSI, Floppy controllers
- Low power consumption; 5 watts
- Multi-media software supports CD ROM's, Audio devices & optical storage
- PC/104 form factor; 4" x 4"
- Ethernet, Serial, Keyboard & Parallel controllers

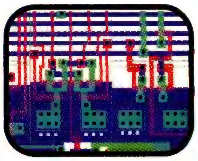
125 Wendell Ave, Weston, Ont. M9N 3K9
(416) 245-2953 Fax: (416) 245-6505

megatel®

MEGATEL **CIRCLE 429**

ASIC SOFTWARE

for PC, Sun, HP and Mac.



See us at Wescon Booth 2438

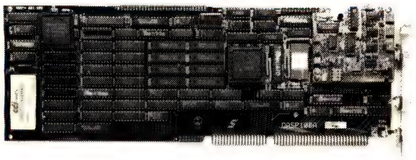
S-Edit: Schematic Editor
L-Edit: Full-custom layout editor
- All-angle polygons & wires
- GDS-II & CIF input/output
- Integrated add-on modules...

DRC: *Design* Rule Checker
Extract: SPICE netlist extractor
LVS: *Netlist comparison* utility
SPR: Std Cell Place & Route
CMOS layout libraries
T-Spice: Circuit Simulator

Call **(818) 792-3000 x303** for your free L-Edit demo disk.

TANNER RESEARCH

TANNER RESEARCH **CIRCLE 426**



DASP100A

DATA ACQUISITION & SIGNAL PROCESSING

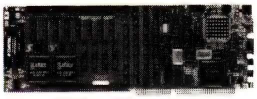
- ★ 100 MILLION SAMPLES PER SECOND
- ★ 256k SIGNAL MEMORY (EXPAND TO 8 MB)
- ★ 10 MIPS DSP (320C25)
- ★ EXTENSIVE HARDWARE & SOFTWARE SUPPORT
- ★ 3 DATA ACQUISITION MODES
- ★ EXTERNAL CLOCK & TRIGGER

ALSO ASK ABOUT OUR DASP25!

Signatec
357 N. Sheridan St. #119
CORONA, CA 91720
(909) 734-3001
FAX: (909) 734-4356

SIGNATEC, INC. **CIRCLE 427**

BREAK THE SPEED LIMIT!!



DA500
500MHz WAVEFORM CAPTURE BOARD

- ISA (PC/AT) compatible board
- 2 analog input channels
- 500 MHz 8 bit digitizer
- 7.0 effective bits at 250 MHz signal
- 256K bytes memory on board
- Memory expandable to **1 Gigabyte!**
- 350 MHz analog bandwidth
- 200 MB/SEC extended Auxiliary Bus
- External clock and trigger inputs

We Supply Solutions! Call us to discuss your application with one of our engineers.

Signatec
357 N. Sheridan St., #119
Corona, California 91720
Phone: (909) 734-3001
FAX: (909) 734-4356

SIGNATEC, INC. **CIRCLE 428**

ELECTRICAL CONDUCTIVE ADHESIVES.

Designed To Your Specifications

MASTER BOND EP76M EPOXY
- ■ High conductivity
- ■ Thermal shock resistant
- ■ Durable, high strength bonds
- ■ Water and chemical resistant
- ■ Repairability
- ■ Long storage stability without refrigeration
- ■ Convenient packaging

For information, call or write:
Master Bond Inc., 154
Hobart St. Hackensack,
NJ 07601. 201-343-8983

Master Bond Inc.
Adhesives, Sealants & Coatings

MASTER BOND **CIRCLE 430**

When it comes to innovative computing technology, Buscon has it all.

MORE manufacturers

See the major players in a single trip! Manufacturers of hardware, software, chips, boards, backplanes, embedded software & more.

MORE innovative solutions

Buscon is the industry's forum for innovation, where hot new products are introduced. Be the first to see them, and implement them in your designs.

MORE applications

No matter what your application—from commercial data processing, to aerospace & military, communications & networking or embedded systems—Buscon is your best resource.

LESS time out of the office

Buscon's all-new format makes it easy to attend, without taking a major chunk out of your busy schedule.

LESS distance to travel

Buscon is right in your back yard, at the Royal Plaza Trade Center October 19-20, 1993 in Marlborough, MA, and the Santa Clara Convention Center February 2-3, 1994 in Santa Clara, CA.

LESS expense

With no charge for admission and no costly overnight stays, it's easy to justify a trip to Buscon.

FREE education

Buscon keeps you up to date with high-level technical sessions and panel discussions on critical industry issues & technologies, sponsored by leading publications.

BUSCON 93

EAST

October 19-20, 1993
Royal Plaza Trade Center
Marlborough, Massachusetts

FREE admission

There's no charge for admission to the exhibit hall, and plenty of free parking on site!

GET TO IT!

To pre-register for BUSCON, or to obtain more information, return the coupon below or call **1-800-243-3238.**

A CMC EVENT

CIRCLE 98 FOR U.S. RESPONSE

CIRCLE 99 FOR RESPONSE OUTSIDE THE U.S.

© CMC 1993

BUSCON 93 EAST

Pre-registration form

☐ Please register me for Buscon '93 East
☐ Please register me for Buscon '94 West
☐ Please send information on exibiting at Buscon ☐ East ☐ West

Name ______________________ Title ______________________
Company ______________________ Division/Department ______________________
Address ______________________ Telephone (   ) ______________________
City ______________________ State ______________ Zip ______________

Mail to: Buscon/CMC, 200 Connecticut Avenue, Norwalk, CT 06856-4990. Fax: (203) 857-4075 BE11

ELECTRONIC DESIGN

Chairman and CEO: Sal F. Marino
President and COO: Daniel J. Ramella
President, Electronics Group: James D. Atherton

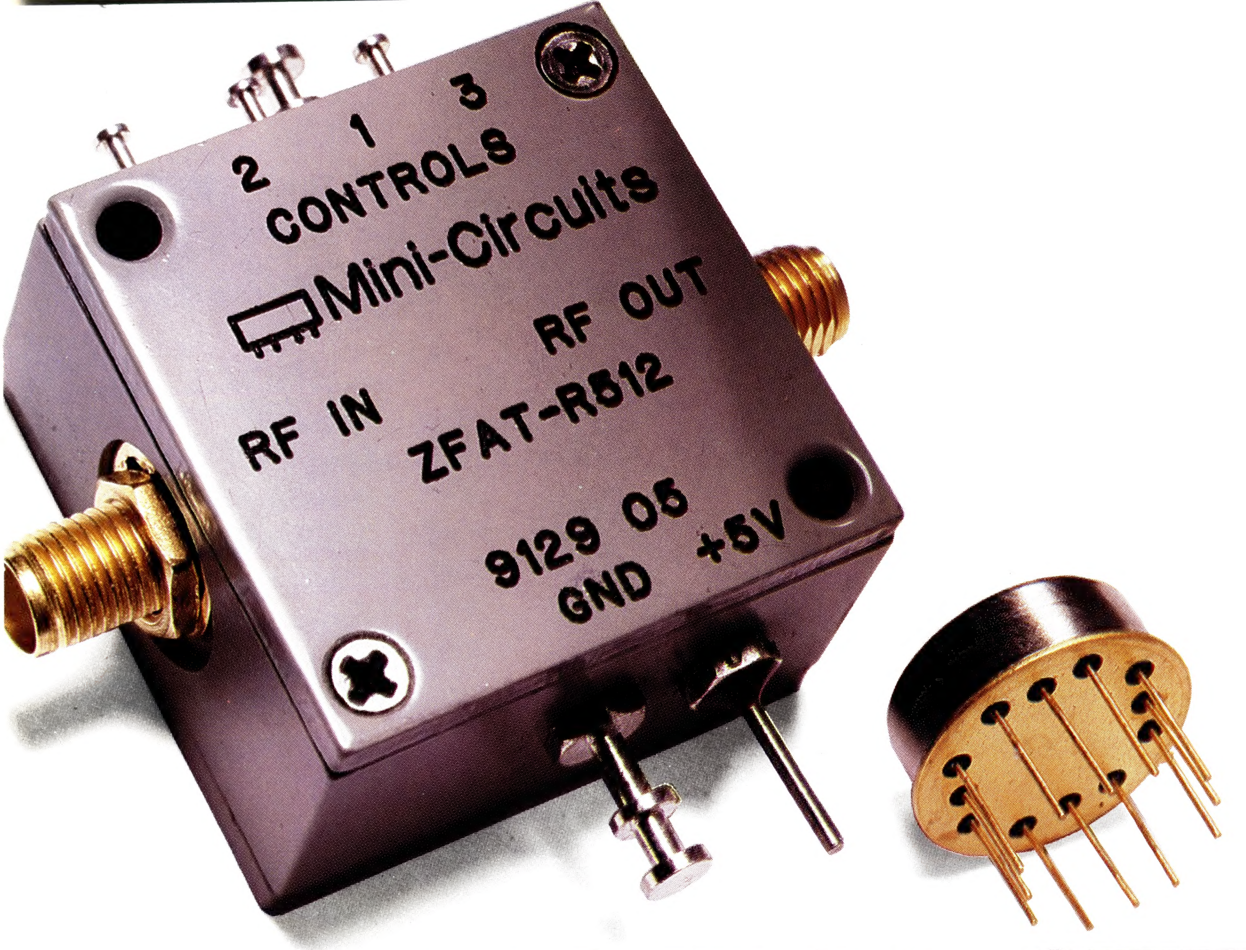
Advertising Sales Staff

Publisher: John R. Carroll
Hasbrouck Heights, NJ; (201) 393-6060
National Sales Manager: Russ Gerches
Hasbrouck Heights, NJ; (201) 393-6045
General Manager, European Operations: John Allen
36 The Green, South Bar Banbury,
Oxford 0X16 9AE, U.K.
Phone: 44 (0)295-271003 FAX: 44 (0)295-272801
Hasbrouck Heights: Judith L. Miller, Jami Radow
Sales Asst.:Jessica Berni
611 Route #46 West, Hasbrouck Heights, NJ 07604;
Phone: (201) 393-6060TWX: 710-990-5071
Boston & Eastern Canada: Ric Wasley
400 Fifth Ave., Waltham, MA 02154;
Phone: (617) 890-0891 FAX: (617) 890-6131
Colorado: Lou Demeter (408) 441-0550
Chicago/Midwest: Mark Kearney
Sales Assistant: Susan Johnson
180 N. Stetson Ave., Suite 2525
Chicago, IL 60601;
(312) 861-0880 FAX: (312) 861-0874
Arizona: James Theriault (408) 441-0550
Los Angeles/Orange County/San Diego: Ian Hill
Sales Asst: Patti Kelly
16255 Ventura Blvd., Suite 200 Encino, CA 91436;
(818) 990-9000 FAX: (818) 905-1206
San Jose:
Jeff Hoopes, Lou Demeter, James Theriault
Sales Administrator: Sarena Owens
2025 Gateway Pl., Suite 354 San Jose, CA 95110;
Phone: (408) 441-0550
FAX: (408) 441-6052 or (408) 441-7336
Pacific N.W. & Western Canada: Jeff Hoopes (408) 441-0550
Texas/Southeast: Bill Yarborough
12201 Merrit Dr., Suite 220, Dallas, TX 75251;
(214) 661-5576 FAX: (214) 661-5573
Direct Connection Ads & DAC Sales Representatives:
Kim Stanger (201) 393-6080
Betsy Tapp (201) 393-6075
Recruitment/Classified: Lois Walsh
(216) 696-7000, ext. 2359 Fax: 216-696-8207
Netherlands, Belgium: Peter Sanders, S.I.P.A.S.
Rechtestraat 58 1483 Be De Ryp, Holland
Phone: 312 997 1303 Fax: 312 997 1500
France: Fabio Lancellotti
Defense & Communication
10 Rue St. Jean 75017 Paris France
Phone: 33-142940244 FAX: 33-143872729
Spain/Portugal: Francoise Schmitt
Publi Schmitt General Yague 8,
Apt. 4C, 28020 Madrid, Spain
Phone: 34-1-5554208 FAX: 34-1-5551450
Scandinavia: Paul Barrett
I.M.P. Hartswood Media,
Portfolio Business Centre
161-165 Greenwich High Road,
London SE10 8JA, U.K.
Phone: 44-81-293-0380 FAX: 44-81-858-9584
Germany, Austria, Switzerland: Friedrich Anacker
InterMedia Partners GmbH
Deutscher Ring 40, 42327 Wuppertal, Germany
Phone: 49 202 711 091 Fax: 49 202 712 431
Hong Kong: Tom Gorman,
China Consultant Intl.
Guardian Hse, Ste 905
32 Oi Kwan Road, Happy Valley, Hong Kong
Phone: 852 833 2181FAX: 852 834 5620
Israel: Igal Elan, Elan Marketing Group
22 Daphna St., Tel Aviv, Israel
Phone: 972-3-6952967 FAX: 972-3-268020
Toll Free in Israel only: 177-022-1331

INDEX OF ADVERTISERS

ADVERTISER	READER SERVICE U.S. / OUTSIDE U.S.	PAGE NUMBER
2500 AD SOFTWARE	415	205
AAVID ENGINEERING	80,81	189
ACTEL	82,83	64-65
ADVANCED MICRO DEVICES	328,329	2-3
AGEMA	84,85	69
ALLEGRO MICROSYSTEMS	254,255	123
ALLEN SYSTEMS	424	206
ALTERA CORPORATION	351,352	60-61
AMP INCORPORATED	246,247	12-13
AMPLIFIER RESEARCH	86	130
ANALOG & DIGITAL PERIPH.	420	205
ANALOG DEVICES	268,269	102-103
ANCOT CORPORATION	88,89	8
APEX	90,91	1
ARIES ELECTRONICS	92,93	52
ASTEC AMERICA	332,333	202
AT&T	306,307	57*
AT&T	304,305	37*
AUTEC POWER SYSTEMS	276,277	144
AVX	359,360	106-107
B&C MICROSYSTEMS	422	206
BAYER	94,95	32-33**
BEIGE BAG SOFTWARE	407	204
BERG ELECTRONICS	320,321	108
BP MICROSYSTEMS	343,344	192
BUD INDUSTRIES INC.	96	145*
BURR-BROWN	297,298	29
BUSCON '93 EAST	98,99	207
C & K COMPONENTS	100,101	148
CASCADE	102,103	159
CIRRUS LOGIC	—	127
CLASSIFIED	—	196
COMLINEAR CORPORATION	106,107	157
COMPONIC	330,331	181
CYBERNETIC MICROSYSTEMS	270,271	14
CYPRESS SEMICONDUCTOR	—	Cov4
DALLAS SEMICONDUCTOR	110,111	156
DALLAS SEMICONDUCTOR	108,109	185
DATAMAN	353,354	193
DATEL INC.	234	111*
DESIGN COMPUTATION	423	206
DIGI-KEY	112,113	7*
DIGITAL EQUIPMENT CORP.	114,115	42-43
DIVERSIFIED TECHNOLOGY	116,117	47
DSP DEVELOPMENT CORP.	338,339	179
EESOF	118,119	153
EVERLITE	340,341	104
FEE FIL-MAG	282,283	169
FORTRON	120,121	8
GENERAL CONTROLS	402	203
HANTRONIX	122,123	78
HARRIS SEMICONDUCTOR	316,317	105
HARTING ELEKTRONIK	124,125	124
HEWLETT PACKARD	126,127	109
IBM MICRO	260,261	80A-L
INNOVATIVE SOFTWARE	419	205
INSTRUMENT SPECIALTIES	128,129	49
INTEGRATED DEVICE TECH.	—	47
INTEL CORPORATION	130,131	32-33*
INTERACTIVE CIRCUITS &SYS.	258,259	165
INTUSOFT	425	206
ISHIZUKA ELECTRONICS	134,135	146
KEMET ELECTRONICS CORP.	136,137	147
KEYSTONE CARBON CO.	272,273	18
KILOVAC	355,356	178
LAMBDA	138,139	112A-D*
LAMBDA ELECTRONICS	312,313	38-39
LAMBDA QUALIDYNE	140,141	140
LECROY CORPORATION	142,143	114
LEXMARK	144,145	55
LINEAR TECHNOLOGY	146,147	191
LITTLEFUSE	148,149	187
MASTER BOND	430	206
MAXIM	347,348	79
MAXIM	349,350	77
MCKENZIE TECHNOLOGY	150,151	139
MEDIA VISION	152,153	172
MEGATEL COMPUTER CORP.	314,315	152
MERITEC	318,319	175
MF ELECTRONICS	242,243	142
MICRO CONTROL	414	205
MICRO NETWORKS	154,155	6
MICROSTAR LABORATORIES	418	205
MINI CIRCUITS	158,159	15
MINI CIRCUITS	156,157	26-27
MINI CIRCUITS	160,161	Cov3
MOTOROLA COMPUTER GROUP	248,249	41
MOTOROLA SEMICONDUCTOR	162,163	20-21
MOTOROLA SEMICONDUCTOR	262,263	10-11
MURATA ERIE	250,251	161
MURRIETTA CIRCUITS	164,165	154
NATIONAL HYBRID INC.	413	205
NATIONAL HYBRID INC.	417	205
NATIONAL INSTRUMENTS	166,167	19
NCR MICROELECTRONICS	266,267	167
NEC CORPORATION	170,171	66-67
NEC CORPORATION	168,169	82-83
NEEDHAM'S ELECTRONICS	172,173	156
NJR CORP.	284,285	134
NOHAU	295,296	72
NOISE LABS	421	205
ORBIT SEMICONDUCTOR	176,177	120B-D
ORCAD	178,179	COV2
PAPST MECHATRONIC CORP.	252,253	163
PHILIPS SEMI CONDUCTORS	182,183	128A-D*
PHILIPS SEMICONDUCTORS	~~184~~	89-91
PHILIPS SEMICONDUCTORS	186,187	111
PICO	308,309	80
PICO	308,309	150
POTTER & BRUMFIELD	292,592	160A-D*
POWERTRONIC SYSTEMS	410	204
PREAGITZER INDUSTRIES	190,191	155
PROTEL TECHNOLOGY	192,193	120
PROTO EXPRESS	400	203
PTD/HYDR. & PNEU. SHOW	—	198-199
PTS	196,197	75
QUALITY SEMICONDUCTOR	264,265	119
RAMTRON CORPORATION	336,337	35
RAYTHEON	256,257	84
ROLYN OPTICS	408	204
SAMSUNG	198,199	16-17*
SAMSUNG SEMICONDUCTOR	200,201	16-17**
SANYO	244,245	183
SEA LEVEL SYSTEMS	404	203
SGS THOMSON	202,203	70-71
SHARP MICRO	204,205	30-31
SIEMENS	206,207	58-59
SIGNATEC	427,428	206
SILICONIX	—	9
SIMTEK CORPORATION	334,335	149
SONNENSCHEIN LITHIUM	208,209	144
SPECTRUM SOFTWARE	293,294	133
STANFORD RESEARCH	214,215	143
SUPERTEX INC.	216,217	92
T-CUBED	406	204
TAL ENTERPRISES	416	205
TANNER SYSTEMS	426	206
TECHNOLOGY CONGRESS	409	204
TEKTRONIX	—	201
TELEBYTE TECHNOLOGY	218,219	152
TELEDYNE RELAYS	220,221	151
TEXAS INSTRUMENTS	—	22-23
TEXAS INSTRUMENTS	224,225	96-97
THOMSON	226,227	196
TOSHIBA	228,229	170-171
TOSHIBA ELECTRONICS	230,231	7**
TRANSDUCTION LIMITED	403	203
VALOR ELECTRONICS	278,279	44-45
VICOR	274,275	49
VIEWLOGIC SYSTEMS	232,233	87
WIND RIVER SYSTEMS	357,358	50-51
WINTEK	401	203
WINTEK	411	204
WIRELESS SYMPOSIUM & EXHIB.	345,346	195
Z-WORLD	405	203

Domestic Edition Only *
International Edition Only **



DIGITAL STEP ATTENUATORS

up to 35dB
10 to 1000MHz
FROM **$59⁹⁵**

OAT-R512 FAT-R512 ccuracy		TOAT-124 ZFAT-124 Accuracy		TOAT-3610 ZFAT-3610 Accuracy		TOAT-4816 ZFAT-4816 Accuracy		TOAT-51020 ZFAT-51020 Accuracy	
dB)	(+/-dB)	(dB)	(+/-dB)	(dB)	(+/-dB)	(dB)	(+/-dB)	(dB)	(+/-dB)
0.5	**0.12**	**1.0**	**0.2**	**3.0**	**0.3**	**4.0**	**0.3**	**5.0**	**0.3**
1.0	**0.2**	**2.0**	**0.2**	**6.0**	**0.3**	**8.0**	**0.3**	**10.0**	**0.3**
1.5	0.32	3.0	0.4	9.0	0.6	12.0	0.6	15.0	0.6
2.0	**0.2**	**4.0**	**0.3**	**10.0**	**0.3**	**16.0**	**0.5**	**20.0**	**0.4**
2.5	0.32	5.0	0.5	13.0	0.6	20.0	0.8	25.0	0.7
3.0	0.4	6.0	0.5	16.0	0.6	24.0	0.8	30.0	0.7
3.5	0.52	7.0	0.7	19.0	0.9	28.0	1.1	35.0	1.0

rice $ (1-9 qty) TOAT $59.95/ZFAT $89.95
old faced values are individual elements in the units

Finally...precision attenuation accurate over 10 to 1000MHz and–55°C to +100°C. Standard and custom models are available in the TOAT(pin)- and ZFAT(SMA)-series, each with 3 discrete attenuators switchable to provide 7 discrete and accurate attenuation levels.

The 50-ohm components perform with 6μsec switching speed and can handle power levels typically to +15dBm. Rugged hermetically-sealed TO-8 units and SMA connector versions can withstand the strenuous shock, vibration, and temperature stresses of MIL requirements. TOAT pin models are priced at only $59.95 (1-9 qty); ZFAT SMA versions are $89.95 (1-9 qty).

Take advantage of this striking price/performance breakthrough to stimulate new applications as you implement present designs and plan future systems. All units are available for immediate delivery, with a one-yr. guarantee, and three-sigma unit-to-unit repeatability.

finding new ways...
setting higher standards

CIRCLE 160 FOR U.S. RESPONSE
CIRCLE 161 FOR RESPONSE OUTSIDE THE U.S.

Mini-Circuits™

WE ACCEPT AMERICAN EXPRESS AND VISA

P.O. Box 350166, Brooklyn,New York 11235-0003 (718) 934-4500 Fax (718) 332-4661

Distribution Centers/NORTH AMERICA 800-654-7949 • 417-335-5935 Fax 417-335-5945 EUROPE 44-252-835094 Fax 44-252-837010

or detailed specs and computer-automated performance data (CAPD), refer to Thomas Register Vol. 23, MicroWaves Product Directory, EEM, or Mini-Circuits' *718-pg Handbook.*

F 140 REV. B

LICENSE TO SPEED.

DMV CALIFORNIA DMV
DRIVERS LICENSE
CY7C199

SRAMs

- 12 &15 ns 256K CMOS SRAMs
- Dual Port SRAMs
- 6 & 8 ns, 256K BiCMOS SRAMs

256K CMOS SRAM

DRIVING LICENCE
PERMIS DE CONCUIRE
KORKORT
SVERIGE
CY7C258/9

PROMs

- State machine PROM speeds along at 100MHz—2x faster than any other PROM
- Processor Intelligent—fastest 256K 16-bit-wide PROM

State Machine PROM

The Commonwealth of Massachusetts
CYM7232

Modules

- DRAM Accelerator runs at 40 MHz
- Cache Memory Modules up to 75 MHz
- Custom modules as fast as 8 ns

DRAM Accelerator

NORTH CAROLINA
DRIVERS LICENSE
CY7C34X

PLDs

- MAX: 0.65 micron shrink–half the size & twice the speed
- 5 ns BiCMOS 22V10
- 7.5 ns Flash 22V10
- Supported by *Warp2* and *Warp3* VHDL design software

MAX 5000

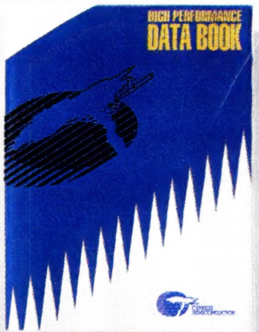
Logic Products

CY7B991/92

運転免許証

- Programmable Skew Clock Buffer—reduces output skew to 500 ps
- 32Kx9 FIFO 33.3 MHz read/write
- VIC64 & companion 964 VMEbus chip—70Mb/s data transfers

Programmable Clock Buffer



BOOK 'EM

If your project demands high performance, throw the book at it. The new IC product Data Book from Cypress Semiconductor. It's free. And invaluable. When you use the Data Book, you can be sure your system will hit the streets running with the fastest components available: Blistering PLDs, PROMs, and SRAMs. Lightning-quick LOGIC, DRAM and Cache SRAM modules. Call/fax for the free Data Book today. And really open it up.

Data Book Hotline: Europe (32) 2-652-0270, ext. 119: *Ask for Dept. C3C*
Asia: Fax your request to: 1-415-940-4336: *Ask for Dept C3C*

CYPRESS SEMICONDUCTOR

Or contact us via Europe fax and Asia telephone numbers listed below.
* The international operator can give you your country's specific access code. Europe: Fax (32) 2-652-1504. Telephone Hong Kong: (852) 3-880-629. India: (812) 566-630 x-3808. Japan: (81) 423-69-82-11. Korea: (82) 2-576-2111. Singapore: (65) 294-8389. Taiwan: (886) 2-820-53-53. © 1993 Cypress Semiconductor, 3901 North First Street, San Jose, CA 95134. Telephone 1-408-943-2600, Telex 821032 CYPRESS SNJ UD, TWX: 910-997-0753.